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Forest Service

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February 2014

Draft Supplemental Environmental Impact Statement for the Invasive Plant Control Project

Carson and Santa Fe National Forests, Colfax, Los Alamos, Mora, Rio Arriba, San Miguel, Santa Fe, Sandoval, and Taos Counties, New Mexico

Cover photo: Bull thistle *(Cirsium vulgare).* Photo courtesy of Forest & Kim Starr, Starr Environmental, Bugwood.org

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Draft Supplemental Environmental Impact Statement for the Invasive Plant Control Project

Carson And Santa Fe National Forests
Colfax, Los Alamos, Mora, Rio Arriba, San Miguel, Santa Fe, Sandoval, and Taos Counties, New Mexico

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Abstract: This draft supplemental environmental impact statement (draft SEIS) updates and corrects some analysis contained in the Forest Service's Final Environmental Impact Statement (FEIS) for the Invasive Plant Control Project for the Carson and Santa Fe National Forests published in September 2005. It keeps the same purpose and need, proposed action, alternatives, adaptive strategy, and design features (also referred to as "mitigation measures") as the FEIS. The substantive updates contained in this supplement are:

- The addition of aminopyralid as an herbicide proposed for use;
- The acres and species of weeds in the forests;
- The analysis of effects in chapter 3; and
- The analysis of effects of the proposed amendment to the Santa Fe National Forest Plan.

The pages in this supplement are intended to replace portions of the FEIS as noted in each section. If something is not addressed in this supplement, it means it has not been updated.

How to Comment

It is important that reviewers provide their comments at such times and in such a way that they are useful to the agency's preparation of the final SEIS. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews.

Send Comments to: Maria T. Garcia, Santa Fe National Forest Supervisor
11 Forest Lane
Santa Fe, NM 87508
comments-southwestern-santafe@fs.fed.us

Date Comments Must Be Received:

The comment period ends 45 days following the date of publication of the notice of availability of the draft supplemental environmental impact statement in the Federal Register. A legal notice will be published in the *Albuquerque Journal* and posted on the two national forests' websites within 4 days of publication in the Federal Register.

Santa Fe National Forest website: http://www.fs.usda.gov/land/santafe/landmanagement

Carson National Forest website: http://www.fs.usda.gov/land/carson/landmanagement

The date of publication in the Federal Register is the exclusive means for calculating the time to submit comments on this draft SEIS. Those wishing to comment should not rely upon dates or timeframes provided by any other source. We expect the notice of availability to be published on or around March 21.

Those who comment during the comment period will be eligible to object to the decision. To be eligible to object, each individual or representative from each organization submitting comments must either sign the comments or verify identity upon request. Comments must meet the requirements of 36 CFR 215.6.

Summary of the Draft Supplemental EIS for the Invasive Plant Control Project

Introduction

In northern New Mexico's Carson and Santa Fe National Forests, more than 15,200 acres of invasive nonnative plant populations (weeds) inhabit National Forest System lands. Although this amount represents less than 0.5 percent of the 3 million acres managed by these two national forests, weed treatments are most effective when the areas affected are small and before weeds are well established. It is important to control weed infestations at an early stage, before costly large-scale treatments such as aerial spraying become necessary.

This supplement summarizes the "Draft Supplemental Environmental Impact Statement for the Invasive Weed Control Project." It provides an overview of the purpose and need for the project, proposed action, the public involvement to date, issue and alternative development, and a summary of the expected effects of alternatives on the human environment.

The pages in this supplement replace portions of the FEIS as noted in each section. Editorial notes are provided in bracketed, bold text. If something is not addressed or written in this supplement, it means it has not been updated and the text in the 2005 FEIS is still valid. This draft SEIS is best read in conjunction with the FEIS. The 2005 FEIS has been posted on the two national forests' Web sites: the Carson National Forest Website and Santa Fe National Forest Website.

Purpose and Need for Action

The purpose of and need for controlling or eradicating weed infestations on the Carson and Santa Fe National Forests is to maintain or improve the diversity, function and sustainability of desired native plant communities in the forests. Protecting the abundance and diversity of native plant communities will also help maintain or enhance other natural resources that can be impacted by weeds and the loss of desired plant communities. Weeds are aggressive, undesirable plants that are a serious threat to the forests. Weeds typically out-compete native plants for space, water, and nutrients, as they have characteristics that give them a competitive advantage over native plant species. They demonstrate high reproductive capacity through prolific seed production and root sprouting. If left uncontrolled, they tend to dominate areas and reduce the diversity and sustainability of native plant populations. In some areas, weeds have increased so dramatically that they create a monoculture by entirely taking over large areas.

Without effective control, weeds will increasingly impact natural resources on the Carson and Santa Fe National Forests in the following ways:

- Native plant communities will become more impacted as weeds gradually dominate these communities. Weeds often form monocultures or greatly simplified ecosystems. Ecosystem processes become degraded, with evidence of slower nutrient cycling and lower hydrological stability. They prove less sustainable when confronted with natural disturbances such as fire. Weeds also threaten the continued existence of certain endangered, sensitive or rare plant species that occur on the forests.
- Erosion is increased by many weed species. Knapweeds and other weeds have a single, deep taproot and drive out native grasses that have better soil-holding root systems. Native riparian

plants including rushes, sedges, willows and cottonwoods maintain streambank stability better than the weed species currently spreading through the national forests' riparian zones.

- Wildlife habitat quality decreases when weeds take over native plant communities. Palatable forage for game and nongame species of wildlife decreases as weeds like thistle, leafy spurge and toadflax take over. Weeds such as black henbane, poison hemlock and yellow starthistle can poison animals. Negative impacts to wildlife magnify in riparian areas because of the important role riparian vegetation plays for a large number of southwestern wildlife species. A large percentage of the known weed infestations occur in or near riparian areas.
- Recreation opportunities are lessened when dense weed infestations limit access to streams and riparian areas. Some weeds cause allergies or skin irritations. Scenic values and wilderness characteristics also typically decline as weeds reduce the abundance and diversity of native plant communities.
- Wildland fires are known to burn more intensely and severely in areas where weed species like saltcedar, Siberian elm and Russian olive have taken over native riparian ecosystems.
- The majority of known weed infestations, totaling approximately 15,260 acres, occur within 150 feet of roads or trails.

In terms of current weed species distribution, the most dominant weed species are the nonnative thistles, followed by the valley bottom species of saltcedar, Siberian elm, and Russian olive. Table S-1 shows the weed species distribution by percent of inventoried weed infestations.

Table S-1. Weed distribution by species

Species	Acres	Percent
Thistles	13,731	70.8
Trees	4,396	22.7
Knapweed	951	4.9
Toadflax	65	0.3
Grasses	131	0.7
Others	118	0.6

Public Involvement and Issues

Collaboration and Scoping

In 1996 and 1997, the Forest Service met informally with other Federal, State and county agencies to discuss the threat of weeds and coordinate treatments. In 1998, the Forest Service began scoping for this project, starting with public meetings held in Taos and Espanola. In March 2000, a letter was sent to approximately 450 individuals, agencies, tribes and organized groups to inform them about the Forest Service's weed control treatment proposals. At that time, each national forest was independently working on separate environmental assessments for forestwide weed control projects. As a result of the March 2000 scoping, a decision was made to combine the efforts of the two national forests and document the analysis in an EIS. In December 2000, the Forest Service sent a new letter to the public about the proposed action. On December 15, 2000, the Forest Service published a notice of intent to prepare an EIS in the Federal Register.

The Forest Service first contacted tribal governments about treating weeds in 1999. The Carson and Santa Fe National Forests included the tribal governments in their March and December 2000 scoping efforts. In December 2003, the Forest Service sent another letter to all potentially affected tribal governments to initiate consultation and solicit their comments about the proposed project.

Issues were identified from the comments received during scoping. The treatment that appeared to be of greatest concern to those who commented was the use of herbicides. Most opposition was based on concerns that herbicides could adversely impact human health, nontarget plants, and wildlife. Concerns over the impact to water quality and fish were also mentioned. Others, on the other hand, were concerned that where nonherbicidal methods were used, there would be less effectiveness and the potential for weeds to spread faster than they could be controlled.

Public Comment on the Draft Environmental Impact Statement

On July 16, 2004, the Forest Service published a notice of availability of the DEIS in the Federal Register. The legal notices announcing the start of the 45-day comment period were published in the newspapers of record on July 22, 2004. The Forest Service received 106 letters on the DEIS; of these, 7 were received after the end of the comment period, which was August 30, 2004.

The Forest Service's interdisciplinary team identified approximately 750 individual comments contained in the letters. As with scoping, the use of herbicides continued to be a main concern among members of the public. In response, the final environmental impact statement (FEIS) clarified and expanded upon its discussion of the risks associated with the use of herbicides (see appendix 3 of the FEIS). Appendix 9 of the FEIS responds to comments received on the DEIS. Other relevant comments were incorporated into the FEIS.

Appeal of the Record of Decision

On September 12, 2005, the Carson and Santa Fe National Forest Supervisors signed a record of decision selecting alternative B. The Forests published a notice of availability of the FEIS and record of decision in the Federal Register on November 18, 2005. The legal notices announcing the start of the 45-day appeal period were published in the newspapers of record on November 23, 2005. Eight appeals of the record of decision were submitted. The Forest Service met with the appellants, but was unable to resolve the issues stated. The Deputy Regional Forester reversed the decision on February 23, 2006.

Draft Supplemental Environmental Impact Statement (Draft SEIS)

The Forest Service has prepared this draft SEIS to correct the deficiencies identified by the Deputy Regional Forester and to update the analysis and facts where needed pursuant to 40 CFR 1502.9(c)(1). In accordance with the Council of Environmental Quality (CEQ) regulations at §1502.9(c)(4), this draft SEIS shall be "prepare(d), circulate(d), and file(d) … in the same fashion (exclusive of scoping) as a draft and final statement." This means that the project will not be re-scoped, but the public will have the opportunity to comment on this draft SEIS before a final decision is made.

In February 2012, the Forest Service sent postcards to 274 people and organizations anticipating the draft SEIS would be published that spring, and asking them how they would like to be notified. We received 17 responses.

Proposed Action

The proposed action is an integrated set of actions to control weeds with the goal of completely eliminating them. Proposing an integrated approach recognizes that using only one management method is not likely to be effective. For the greatest likelihood of success, flexibility is needed to address differences in site-specific conditions. The weeds proposed for treatment are any listed on the New Mexico Department of Agriculture's noxious weeds list, either at the time of this writing or listed in the future. As of this writing, 21 of the 37 listed weeds are known to occur in the Carson and Santa Fe National Forests, and 5 have the potential to occur. The two national forests do not intend to treat some of the listed species, such as St. John's wort (*Hypericum perforatum*) and wild licorice (*Glycyrrhiza lepidota*), because they are medicinal plants.

Treatments would begin in 2015. During approximately the next 10 years, each national forest anticipates treating 300 to 800 acres per year, based on anticipated funding. The maximum that would be treated per year, given sufficient funding, would be 3,000 acres (1,500 acres on each forest). The implementation period could extend beyond 10 years if adaptive management monitoring shows the results lie within the expected sideboards. The following methods are proposed:

- Hand pulling, grubbing with hand tools or hand operated power tools, mowing and disking, girdling, or plowing with tractor-mounted implements;
- Biological control using insects or plant pathogens introduced into the weed habitat;
- Controlled grazing using goats and sheep to intensively and repeatedly graze weeds;
- Herbicide application using hand or vehicle-mounted sprayer applications; and
- Prescribed burning using limited pile or broadcast burning to eliminate seed heads and resident populations of weeds.

Reseeding or replanting after the initial treatment would follow in some situations, since this has been shown to increase the effectiveness of controlling weeds (Endress et al. 2012).

The scope of the proposal includes treatments to existing weed infestations, as well as an adaptive strategy for responding to infestations that have not yet been discovered or established. The adaptive strategy would evaluate new weed populations and, if the effects fall within parameters described in this draft SEIS, permit immediate treatment. Failure to deal immediately with these new—usually small—infestations is likely to lead to larger scale treatments with greater impacts later.

Alternatives Considered in Detail

This section summarizes the four alternatives considered in detail in the draft SEIS, the adaptive management strategy, treatment objectives and decision criteria, mitigation and monitoring requirements, and the forest plan amendment.

Alternative A - No Action. This is the baseline for comparing the other alternatives and is the alternative where proposed weed control actions would not occur on the two national forests.

Alternative B – Proposed Action. This is the agency's proposed action as previously described, developed to fully meet the purpose and need for action while minimizing the risk of adverse impacts through design features and monitoring requirements.

Alternative C - No Herbicides. This alternative eliminates herbicide use and was developed in response to public concerns raised about potential effects of herbicides on human health, fish, wildlife, and nontarget native vegetation.

Alternative D - Herbicides Only. This alternative exclusively relies on herbicides and was developed in response to the cost effectiveness issue associated with proposed nonherbicide treatments.

Adaptive Strategy

The action alternatives (alternatives B, C, and D) employ an adaptive strategy. Using this adaptive strategy, weed treatments would be monitored, evaluated and modified as necessary to improve effectiveness of future treatments or reduce the potential for adverse effects to people and natural resources. This strategy also allows for applying the same weed control treatments to new weed infestations as long as the actions and effects (including decision-making criteria and limitations on treatments) are within the scope of the EIS and record of decision.

The adaptive strategy would cover weeds found in newly surveyed areas, newly established populations, or weeds newly listed as noxious by the State of New Mexico in the two national forests. The Carson and Santa Fe National Forests propose an adaptive strategy with the following actions:

- Annually inventory portions of the two national forests that are likely to have new infestations (e.g., areas burned by wildfires or recently disturbed) and map them. Budgets will govern the extent of these inventories.
- Identify the weed treatment objective, priority, and methods to use for newly mapped infestations, based on the specific criteria described in the EIS.
- Monitor the effectiveness and effects of weed treatment activities and associated design features.
- Evaluate and disclose monitoring results, and use those results to determine appropriate modifications in treatment prescriptions, design features or implementation practices.
- Implement modifications or other feasible and appropriate treatment methods based on monitoring results, as long as the action and its effects are considered by an interdisciplinary team and determined by the responsible official to be within the scope of actions and effects evaluated in the EIS (in accordance with Forest Service Handbook FSH 1909.15, Sec.18).

Treatment Objectives and Decision Criteria

Specific treatment objectives for a given weed species fall into one of the following categories:

- Eradication
- Control (reducing the population over time)
- Containment (preventing the population from spreading)

Eradicating or controlling every weed infestation in 1 or 2 years is beyond the budget and personnel resources of the two national forests. Therefore, a system for setting priorities is proposed so that treatment concentrates on invasive species that have the greatest impact on the resource base, and those invasive plants that become more difficult to control if action is delayed.

Weeds become much more difficult to control once they have spread. Thus, the highest priority is to eradicate new species occurrences on the two national forests, and then to keep existing populations from spreading or increasing in size.

In addition, new weed infestations found in the following locations would be considered for a possible elevated priority ranking:

- Areas that are now relatively weed free and have little or no road access, such as areas designated as wilderness, roadless recreation or semiprimitive, or nonmotorized, including the road corridors and trails that lead to those areas.
- Areas that are now relatively weed free that provide unique and desirable wildlife habitat, such as recovery habitat for threatened or endangered species, deer and elk winter range; and riparian habitat.
- Areas on the two national forests with weed populations adjacent to other land ownerships where land managers have active weed control programs.
- Areas of high human use, including but not limited to administrative sites, developed recreation sites such as campgrounds, scenic viewpoints, interpretive sites, and trailheads.

Schedules for implementing weed treatments would be based first on the priorities just described, and spread out over time based on levels of funding and staffing on the two national forests.

Selection of treatment method is based to a large extent on the priority ranking of the weed species and the objective for a particular site, which is dictated by factors such as proximity to water or roads (which increases chance of weed spread), and the size of the weed infestation (small sizes are easier to eradicate).

In addition to using treatment objectives, priority rankings, and infestation size, other specific site conditions would prescribe treatment method limitations. Where present, these conditions would dictate use of methods that have a low risk to the resource factor of concern:

- Areas of high human use such as a recreation site, administrative site, or area where people often collect plants.
- Areas with a shallow water table (less than 6 feet deep) and soil with a high permeability rate, where there may be a risk of an herbicide leaching through the soil to the groundwater.
- Riparian areas or next to live water bodies containing aquatic species.
- Presence or proximity of threatened, endangered or sensitive plant species.
- Presence or proximity of threatened, endangered or sensitive wildlife species.
- Wilderness and designated nonmotorized areas.

Mitigation and Monitoring

This draft SEIS lists design features and monitoring requirements for all action alternatives. The mitigations were developed specifically for this project in order to avoid or minimize the risk of adverse impacts to human health and safety, native plants, special status plants or wildlife, soil, water, riparian and aquatic resources, and heritage resources. The bullets that follow summarize design features that are described in more detail in the draft SEIS.

- **Human Health/Safety and General Mitigations:** These govern herbicide application and use, public notification, traffic control, and other protection measures.
- **Native Vegetation and Treatment Effectiveness:** These direct the treatments so that they have a minimal impact on native vegetation. They include cleaning equipment, revegetation (or mulching as appropriate), and use of proper seed to revegetate.
- **Threatened, Endangered and Sensitive Plants:** These require survey and/or avoidance of occupied habitat. For Holy Ghost ipomopsis, buffers apply to treatments such as grazing, mowing, and prescribed burning. Herbicide use is prohibited within and for 25 feet around Holy Ghost ipomopsis plants and occupied habitat.
- **Wildlife, including Threatened, Endangered and Sensitive Species:** Depending on the level of protection required by law, regulation and policy, these measures require surveys and/or avoidance, and use of seasonal restrictions to reduce impacts during breeding periods. For example, controlled grazing with sheep or goats is prohibited in Rocky Mountain bighorn sheep habitat.
- **Air, Soil, Water, Riparian and Aquatic Resources:** These measures restrict some treatments in certain places, such as slope restrictions for mechanical treatments and herbicide use restrictions near water. Although most herbicides would be permitted near water if registered for such use by the EPA, no direct application of herbicide to water is permitted as part of this project in order to avoid impacts to native fish. Procedural restrictions also apply. These include complying with smoke management for prescribed burns, and evaluating watersheds for total herbicide use before proceeding. Potential for accidental spills of herbicides, gasoline or other chemicals associated with treatments would be minimized by restrictions on where these chemicals can be handled. Spill prevention and cleanup plans and other established procedures also reduce the impacts to soil, water, and aquatic resources.
- **Heritage Resources:** A programmatic agreement exists to ensure that heritage resources would be protected in accordance with applicable law, regulation and policy. The programmatic agreement spells out the requirements for conducting heritage resource inventories and evaluations for this project prior to implementation. It requires development of appropriate design features to avoid adverse impacts to heritage resources.
- **Monitoring and Adaptive Management:** Inventory and mapping of weeds will be conducted annually. Treatment of newly found populations will be identified and prioritized. Treatments will be monitored for effectiveness and effects to other resources. If the treatments initially prescribed in the EIS are not effectively meeting the given treatment objective, another method may be used as long as the action and effects are within the scope of effects considered in the EIS. The evaluation and decision by the responsible official regarding consistency with the EIS will be documented in the project record.

Forest Plan Amendment

Alternatives B and D include a nonsignificant, programmatic amendment to the Santa Fe National Forest Plan. The amendment would allow the use of herbicides in places currently prohibited by forest plan standards and guidelines. These areas are in municipal watersheds and on soils with low revegetation potential. No amendment is proposed for the Carson National Forest Plan because it does not prohibit the use of herbicides in any specific areas.

To meet the purpose and need for this project and protect ecosystem diversity and sustainability in the long term, it may be necessary to occasionally apply herbicides within those areas if they are infested with weed populations that cannot be effectively treated with other methods. The proposed amendment would continue to protect municipal watersheds, soil productivity, and human health and safety. For instance, soil erosion rates would still be required to remain within tolerance levels based on the terrestrial ecosystem survey data, in order to maintain long-term soil productivity. Table S-2 shows the specific language changes in forest plan direction.

Table S-2. Proposed amendment to the Santa Fe National Forest Plan (pp. 75-76; bold text is new language)

Existing Forest Plan Direction	Proposed Forest Plan Direction
5. Chemical treatments may be applied:	5. Chemical treatments may be applied:
a. when determined through an environmental analysis to be environmentally, economically, and socially acceptable.	a. when determined through an environmental analysis to have **no adverse environmental, economic, or social impacts for longer than 6 months.**
b. on areas outside municipal watersheds and human habitation.	b. **within** municipal watersheds **only when the municipality concurs with the proposed treatment and design features.**
c. on soils with moderate or high revegetation potential.	c. **on any soil provided that soil erosion on that site is not increased to above the tolerance level identified in the terrestrial ecosystem survey for the affected soil unit.**
d. on areas that would benefit from selective control of plant species.	d. on areas that would benefit from selective control of plant species.
e. on areas where the chemicals will not violate State water quality standards.	e. on areas where the chemicals will not violate State water quality standards.
f. on soils with moderate to high cation exchange capacity.	f. **In areas of** human habitation: • **Apply this adaptive strategy identified in the EIS in table S-10: Method(s) must have been documented to be low risk of causing harm to people.** • **Apply the design features listed in the EIS in table S-11 under "Human Health/Safety and General Mitigations."**
g. on piñon-juniper retreatment areas on stands where 80 percent of the trees are less than 6 feet in height, with more than 25 trees per acre.	g. on piñon-juniper retreatment areas on stands where 80 percent of the trees are less than 6 feet in height, with more than 25 trees per acre.

Environmental Consequences and Comparison of Alternatives

This section provides a comparative summary of the alternatives in terms of the most significant issues or effects anticipated, based on the analysis in the EIS.

Summary of Environmental Consequences

The most noticeable consequences from weed treatment alternatives B, C, and D would be the long-term beneficial improvements to native ground vegetation such as grasses, forbs and shrubs. Riparian vegetation such as rushes, sedges, willows and cottonwoods would particularly benefit from this project. Protecting and improving native plant communities would have positive effects on soil and water conditions, as well as wildlife and aquatic habitats (particularly due to enhancing riparian vegetation).

Negative effects to native vegetation, soil, water and aquatic organisms would be minor and of short duration. The minor, short-term increases in sediment (more with alternative C) and herbicide delivery to streams (alternatives B and D) would have no significant consequences. There would be a low risk of adverse impacts to fisheries, including Rio Grande cutthroat trout (a sensitive fish species) or other aquatic organisms based on use of design features, risk assessment and EPA guidelines. Alternative C would cause more ground disturbance and associated impacts to soils, especially on soils with severe erosion hazard rating. However, all alternatives would remain with soil erosion tolerance levels needed to protect long-term soil productivity. Soils with low revegetation potential would receive herbicide treatments in alternatives B and D, while reestablishing native vegetation would take longer under alternative C. Mitigation requirements for all alternatives would ensure that vegetative ground cover is adequately reestablished. With the required design features, all soil and water quality standards would be met.

Differences between alternatives in their effects to air quality, heritage resources, livestock grazing, recreation, wilderness and visual resources are expected to be negligible, such that they would not be given weight in the decision-making process. There would be minor increases in noise and traffic, although generally within background levels.

By controlling the spread of weeds and protecting native plant communities, habitats and watershed conditions on the two national forests, alternatives B and D would maintain or enhance social or economic conditions, particularly for local rural communities in northern New Mexico who typically rely on the two national forests' natural resources for their livelihood, traditional culture and quality of life.

Comparison of Alternatives

The alternatives are compared in terms of the significant issues, as well as how well they meet the purpose and need (objectives) for the project. Table S-3 provides the comparison of alternatives, based on the detailed environmental analysis documented in the FEIS. The comparison table is intended to provide a clear basis for choice between alternatives.

Table S-3. Comparison of alternatives by issues and objectives (purpose and need)

Significant Issues and Objectives	Alternative A	Alternative B	Alternative C	Alternative D
Issue 1: Herbicides and Human Health	No risk of health impacts from herbicide exposure (0 acres treated with herbicides).	Low risk of health impacts to workers or general public from using herbicides based on EPA registration, risk assessment data, and design features. Higher risk to people with multiple chemical sensitivities, although public notification requirement provides a means for people with this condition to avoid exposure to treated areas.	No risk of health impacts from herbicide exposure (0 acres treated with herbicides). Slightly increased risk of exposure to smoke from prescribed burning.	Same as alternative B but slightly higher risk of exposure for people with chemical sensitivities as 100 percent of treatments are with herbicides.
Issue 2: Herbicides and Wildlife	No risk of herbicide impacts to wildlife. Weeds would degrade native plant habitats, especially riparian areas important to numerous species.	Low risk of herbicide impacts to wildlife based on EPA registration, risk assessments, and design features. Native wildlife habitat quality (especially riparian habitat) would improve as weeds are eradicated and controlled.	No risk of herbicide impacts to wildlife. Less improvement in wildlife habitat.	Same as alternative B
Issue 3: Herbicides and Native Plant Communities	No short-term impacts from herbicides. In the long term, weed-caused decline in abundance and diversity of native plant communities.	Short-term reduction in some nontarget plant species. Long-term improvement in abundance and diversity of native plant communities.	Similar to alternative B for short-term reduction in nontarget plants. Low to moderate long-term improvement in native plant communities. Weed spread rate may equal or exceed control rate without herbicide use.	Same as alternative B
Issue 3 Continued: Rare or Sensitive Native Plant Species	No risk of treatment-related impacts. In the long term, weeds may cause a decline in federally listed or sensitive plant species	No impact to threatened or endangered plants due to mitigation measure. For sensitive plants, treatments “may impact individuals but are not likely to result in a trend toward Federal listing or loss of population viability,” due to design features and species locations.	Same as alternative B	Same as alternative B
Issue 4: Cost and	No cost effectiveness; would	Moderately cost effective.	Least cost effective.	Most cost effective.

Significant Issues and Objectives	Alternative A	Alternative B	Alternative C	Alternative D
Treatment Effectiveness (based on level of effort to meet objectives)	incur much higher costs in future.			
Objectives: Protect native plant communities, soil and water quality, wildlife habitat, and long-term ecosystem health	No protection; no effectiveness. Weed-related impacts to vegetation, soil, water, riparian habitat, etc. would continue.	Highest level of treatment effectiveness and resource protection from weed impacts due to combination of treatments including herbicides.	Lowest level of effectiveness and resource protection from weed impacts. Fewer acres treated annually for a given budget due to need for repeat treatments on the same acreage more often than when combined with other methods.	High level of effectiveness and resource protection from weed impacts. Not quite as effective as herbicides combined with other methods.

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Preface

Notes on This Document

- The pages in this supplement replace portions of the FEIS as noted in each section. Editorial notes are provided in bracketed, bold text. If something is not addressed or written in this supplement, it means it has not been updated and the text in the 2005 FEIS is still valid. This draft SEIS is best read in conjunction with the FEIS. The 2005 FEIS has been posted on the two national forests' Web sites:

  Carson National Forest Web site
  Santa Fe National Forest

- Tables and figure numbers are preceded by "S-." Where a table or figure replaces one from the FEIS, it is noted.
- A limited number of paper copies of the FEIS and draft SEIS are available from the Carson and Santa Fe National Forests.
- Throughout this document, the term used for invasive plants will be "weeds."
- "Design features" and "mitigation measures" are used interchangeably.
- This document contains revised acreage numbers. When consulting the FEIS, refer to this document for the correct acreages.
- The risk assessments for certain herbicides have been updated, and these shall replace or complement the earlier risk assessments. Any references to the risk assessments shall now include those listed in appendix 3 (SERA 2003a – 2007).
- Most resource specialists wrote their section directly into this document; thus, separate, updated "specialist reports" exist only for Heritage Resources and for Social and Economic Resources. The information in this draft SEIS supersedes the specialist reports prepared for the 2005 FEIS.

Chapter 1. Purpose of and Need for Action

Introduction and Setting

[No change from FEIS]

Definition of Invasive Plant

[New section]

Executive Order 13112 defines an invasive species as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." This definition encompasses plants, animals, and microorganisms. Figure S-1 illustrates the definition of an invasive plant, interpreted by the authors of this supplement, as further defined by the Invasive Species Advisory Committee (2006). States, not the Federal government, identify a species as "noxious;" these tend to be a subset of invasive species. Although invasive species come in many life forms, such as mammals, fungus, or insects, this document addresses plants (weeds) only.

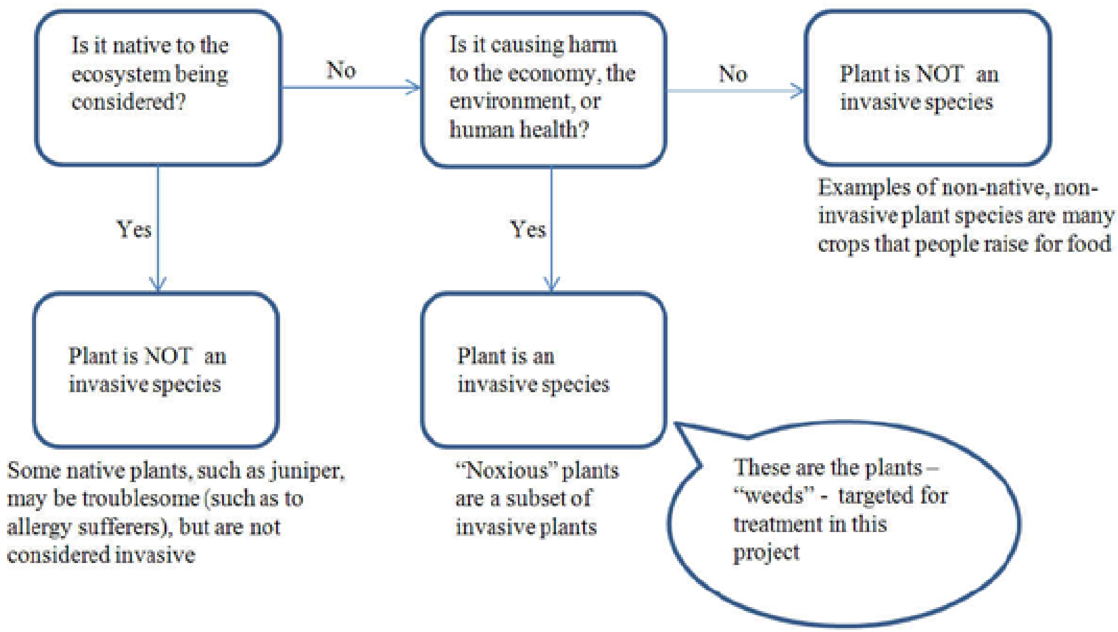

Figure S-1. An illustrative concept of the definition of an invasive plant, or "weed"

Purpose and Need for Action

[Replaces third paragraph]

In general, weed invasion and spread results in a loss of natural diversity and reductions in the quality of wildlife habitat, soil stability and water quality. Weeds can alter ecosystems by changing the frequency and intensity of wildfires (Quigley and Arbelbide 1997, DiTomaso 2000, Tu et al. 2001, ISAC 2006). More specifically, where weeds occur and continue to spread over native grasslands, riparian areas, rare plant areas, and other sites on the Carson and Santa Fe National Forests, they are causing a reduction in the abundance and variety of native plants. This, in turn, impacts the abundance and diversity of wildlife species that depend on those native habitats. In addition, the root systems of some weed species do not hold soil in place as well as native plants, resulting in increased soil erosion and streambank instability (Lacey et al. 1989, ISAC 2006). Some weeds, such as saltcedar (also known as tamarisk) reduce water quantity, which is particularly critical to the arid lands in New Mexico (ISAC 2006).

[Replaces fourth paragraph]

In New Mexico, the occurrence of weed species is increasing. Existing populations are predicted to spread, and new weed infestations are projected to appear each year (Renz 2004). While the number of known weed infestation sites on the two national forests is relatively small, occupying less than half of 1 percent of the 3 million acres of land in the Carson and Santa Fe National Forests, there are likely more weed infestation sites that have not yet been discovered. Weeds typically spread at a rate of between 5 and 30 percent per year, depending on the plant species and site-specific conditions (DiTomaso 2000, Tu et al. 2001, Frid et al. 2013).

[Replaces 3rd bullet]

- Water quality is impacted by weeds. Across the two forests, almost 8,600 acres of known weed populations are found in valley bottom lands and within 150 feet of streams. As native vegetation changes to one or more weed species, the amount of surface water runoff and stream sedimentation is likely to increase as well. Weeds that have been found to displace native rushes and sedges along streams typically reduce the soil stability of those streambanks (Enloe et al. 2004). Water quality can become degraded from these changes in plant composition along streams. Water infiltration rates can be reduced where weeds dominate, and their presence influences soil moisture and nutrient availability (DiTomaso 2000).

[Replaces 2nd, 3rd, and 5th bullets, p. 15]

- Wildlife habitat is degraded or lost when weeds cause a decline in native vegetation that provides cover, seeds, and habitat for small mammals. Over decades, large areas of weeds would likely lead to a reduced populations of deer, elk and nongame wildlife populations (FICMNE 1998). Palatable forage for game and nongame wildlife species decreases as weeds take over (DiTomaso 2000). The North Ponil area on the Carson National Forest has more than 1,300 acres of bull thistle, along with small populations of knapweed and leafy spurge, threatening this area's habitat quality. In addition, livestock and wildlife can be injured or die from weeds that are poisonous to animals that feed on them, such as black henbane and poison hemlock (FICMNE 1998). Yellow starthistle can induce a neurological disorder in wild or domestic horses that is usually fatal.
- Weeds can impact the quality of recreational activities on the two national forests. Along trails, hikers encounter thistles and knapweeds that have spiny flowers and leaves. Dead weed stalks are known to impede access to meadows and riparian areas, or discourage return trips (FICMNE 1998). Increased weed spread is expected along popular recreation use corridors such as State Highway 38 (Questa Ranger District), State Highway 4 (Jemez Ranger District) and State Highway 63 (Pecos/Las Vegas Ranger District). The North Ponil area of the Questa Ranger District demonstrates this growing conflict as bull thistle populations spread through the Ponil Fire burned area. Saltcedar is becoming so dominant along some streams that it is limiting public access to those popular streamside areas (USDA Forest Service 1998b, 1998c). In addition, forest visitors and workers may come in contact with some weeds such as black henbane, which pose a health threat.

- Wilderness characteristics could be threatened as weeds spread into these areas and form monocultures, reducing the natural diversity and integrity of native plants and animals. These changes in plant composition lead to detrimental changes in ecological processes and functions. Known weed populations in wilderness areas on the two forests total approximately 560 acres.

Background: Existing Condition

[Replaces entire section]

The New Mexico Department of Agriculture (NMDA) established a list of 37 weed species considered to be "noxious" and known to occur or with potential to occur within the State (NMDA 2009). The NMDA categorizes the weeds into four classes:

- **Class A weeds** (21 species) are not present or have very limited distribution in the state
- **Class B weeds** (10 species) exist only in particular areas of the state
- **Class C weeds** (6 species) are wide-spread throughout the state
- **Watch list weeds** (8 species) have the potential to become problematic, but more data is needed before listing them as noxious

Of the 37 noxious weeds listed with the NMDA, 21 species are known to occur in the two national forests, and 5 species have potential to occur there. Table S-4 lists these species and their main threat to the two national forests. For a more detailed discussion, see appendix 2, "Weed Species Ecology and Impacts."

Photo 1. Russian knapweed in the Gallina area, Coyote Ranger District (Santa Fe National Forest photo)

Table S-4. Weed species locations and impacts (shows the changes from the FEIS only)

Weed Species and NMDA Class	Life Cycle[1]	Location	Impact
 Tree of Heaven (*Ailanthus altissima)* AIAL (Class B)	Perennial	Found in fence rows, roadsides, and waste areas.	Threat to natural areas because of tendency to invade.
 Spotted knapweed (*Centaurea biebersteinii*) CESTM (Class A)	Biennial or short-lived perennial.	Prefers disturbed areas to establish but can spread into undisturbed areas once in a site.	Highly adapted to capturing moisture and nutrients so it can spread and choke out native species. Decreases the water storage capacity of soil and can increase soil erosion potential by replacing native plants' network root system with taproot.
 (Fuller's) teasel (*Dipsacus fullonum*) DIFU2 (Class B)	Biennial	Found disturbed areas, abandoned fields, and along roadsides.	Prickly plant with spines or sharp edges, can crowd out native plants and is known to form a monoculture.
 Cheatgrass (*Bromus tectorum*) BRTE (Class C)	Annual	Found on all exposures and types of topography desert valleys to mountains.	Quickly invades burned areas, roadsides, and other disturbed sites outcompeting desired perennial vegetation.

Weed Species and NMDA Class	Life Cycle[1]	Location	Impact
 Saltcedar (tamarisk) (*Tamarix* spp.) TARA (Class C)	Perennial shrub	Riparian areas	Replaces native wood species such as cottonwood, willow, and mesquite. Chemically alters the soil to eliminate competition from native species to reduce the habitat effectiveness for native wildlife species. Uses more water than native species and changes the flood/sediment deposition regime so that native species such as cottonwood cannot regenerate.
Remove field bindweed (COAR4) from list			

1. The life cycle of a weed species along with its means of reproduction (seed, root sprouting, and so forth.) help determine how fast a weed species can take over a site, spread to new places, and how well it can be controlled. Perennial plants persist year after year and so can have a high capacity to spread by roots. These types of weeds can be rather difficult to control. Annuals grow and die after a single year and may be more vulnerable to control actions that disrupt this cycle pattern. Biennials take 2 or more years to complete their life cycle and may be the most susceptible to control efforts that disrupt their reproductive pattern.

Figure S-2 [replaces figure 2 in the FEIS] is a map of weeds in the project area, although the points on the map do not accurately represent the size or extent of each weed infestation.

In a broad sense, a weed may be thought of as simply a plant out of place. A plant may be desirable in one place and undesirable in another: for example, grass in a lawn compared with grass in a garden; or a Russian olive tree decorating a suburban home compared with invading a wildland riparian area.

For the last several years, resource specialists on both forests have noticed weed species increasing on the two national forests. Forest Service personnel started surveying weeds in 1997 and have continued up to the present. The first surveys sampled a portion of each ranger district and found 16 species. The surveys completed to date do not cover the entire project area. Not all disturbed sites (such as recent fires) have been completely surveyed, but these areas serve as likely places for weeds to gain a foothold. As summarized in table S-6 and displayed in figure S-2, of the 3,030,721 million acres of National Forest System lands in the project area, there are approximately 13,256 acres of known weed infestations in a wide range of sizes and a broad distribution. The size of each infestation currently varies from less than 1 acre to over 1,000 acres. Most infestations (more than 75 percent) are less than 1 acre; an ideal size for effectively treating them (Frid et al. 2013). Appendix 7 lists the known weeds and their most effective treatments. The acres of weeds shown in this document do not reflect the density of weeds in each site. Most sites have native vegetation that would not be treated.

Most weed-infested sites require repeat treatments of the same area to meet the treatment objectives (e.g., complete eradication or long-term control).

Table S-5 shows the distribution of known weeds in the project area by general landform type.

Table S-5. Weeds by landform type

Infested Areas	Estimated Acres*	Minimum Size	Maximum Size	Average Size
Within 150 feet of open system roads	4,593	0.003	1,182	67
Within 150 feet of trails, motorized and nonmotorized	12,070	0.01	2,793	19
Riparian areas (150 foot buffer)	3,815	0.002	827	67
Valley bottoms (150 foot buffer)	4,777	0.004	850	76
Scattered	4,818	0.01	1,306	110
Within 50 feet of well pads (Jicarilla Ranger District)	150	0.01	97	15
In wilderness	561	0.002	252	19
Within 150 feet of a trailhead	9	0.0002	3	1

* Some invasive plant populations may fall into more than one category and would be counted more than once.

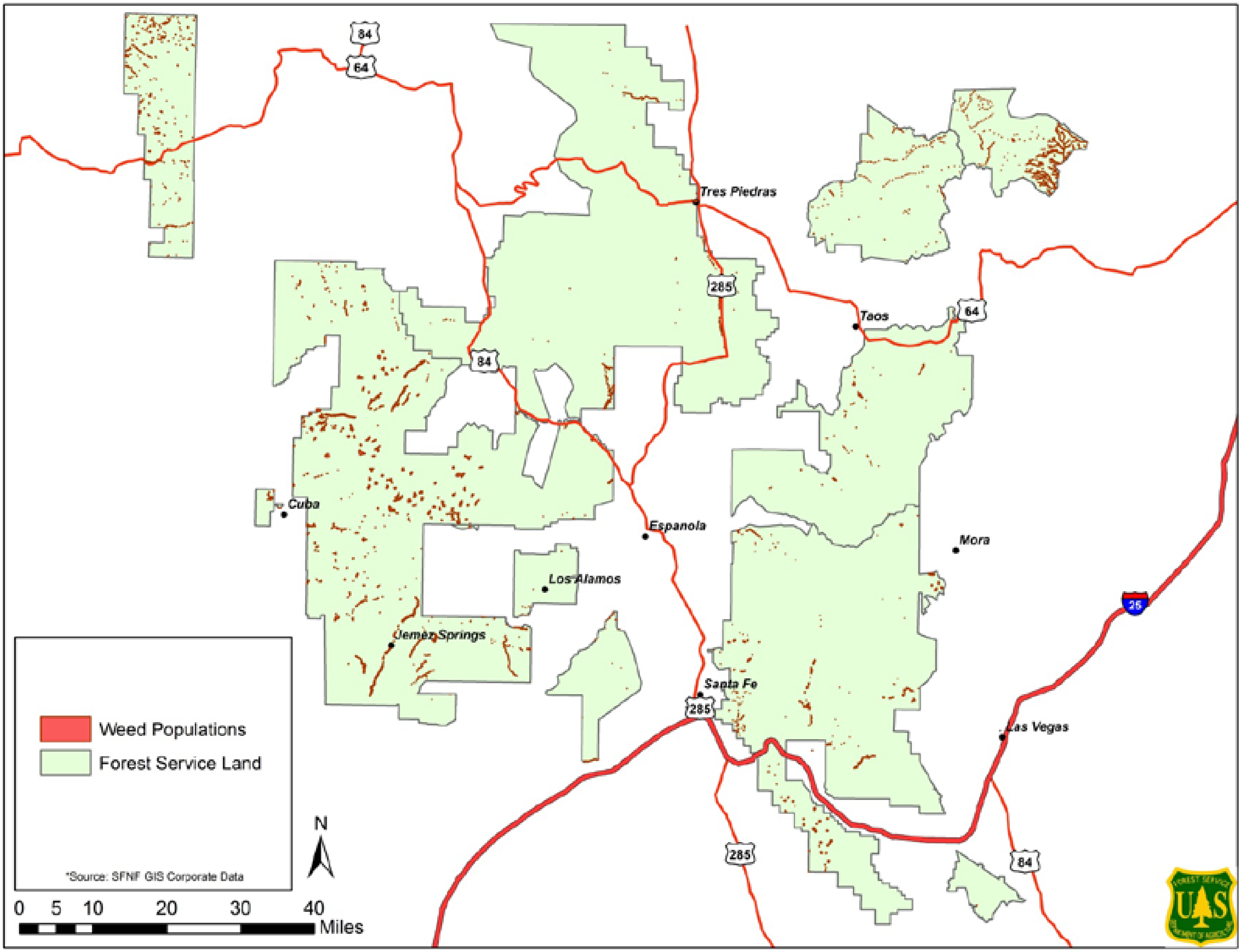

Figure S-2. Weed distribution in the project area

Table S-6 shows weed species and their known abundance as of August 1, 2013.

Table S-6. Weed species and their abundance in the project area

Common Name	Scientific Name	Forest	Acres[1]
Russian knapweed	*Acroptilon repens*	Carson NF	41
Russian knapweed	*Acroptilon repens*	Santa Fe NF	69
tree of heaven	*Ailanthus altissima*	Santa Fe NF	0.1
cheatgrass	*Bromus tectorum*	Santa Fe NF	74
whitetop	*Cardaria draba*	Carson NF	49
whitetop	*Cardaria draba*	Santa Fe NF	8
musk thistle	*Carduus nutans*	Carson NF	585
musk thistle	*Carduus nutans*	Santa Fe NF	3,158
diffuse knapweed	*Centaurea diffusa*	Carson NF	394
diffuse knapweed	*Centaurea diffusa*	Santa Fe NF	108
yellow star-thistle	*Centaurea solstitialis*	Carson NF	1
spotted knapweed	*Centaurea stoebe* ssp. *micranthos*	Santa Fe NF	339
Canada thistle	*Cirsium arvense*	Carson NF	310
Canada thistle	*Cirsium arvense*	Santa Fe NF	5,325
bull thistle	*Cirsium vulgare*	Carson NF	1,647
bull thistle	*Cirsium vulgare*	Santa Fe NF	2,183
poison hemlock	*Conium maculatum*	Santa Fe NF	22
Fuller's teasel	*Dipsacus fullonum*	Santa Fe NF	0.1
Russian olive	*Elaeagnus angustifolia*	Carson NF	331
Russian olive	*Elaeagnus angustifolia*	Santa Fe NF	919
leafy spurge	*Euphorbia esula*	Carson NF	9
leafy spurge	*Euphorbia esula*	Santa Fe NF	0.02
black henbane	*Hyoscyamus niger*	Carson NF	44
perennial pepperweed	*Lepidium latifolium*	Carson NF	43
Dalmatian toadflax	*Linaria dalmatica*	Santa Fe NF	18
yellow toadflax	*Linaria vulgaris*	Carson NF	47
Scotch thistle	*Onopordum acanthium*	Carson NF	130
Scotch thistle	*Onopordum acanthium*	Santa Fe NF	392
tamarisk / saltcedar	*Tamarix ramosissima*	Carson NF	548
tamarisk / saltcedar	*Tamarix ramosissima*	Santa Fe NF	1,090
Siberian elm	*Ulmus pumila*	Santa Fe NF	1,509

1. Because more than one species may exist in a mapped footprint, the acres total more than the 15,256 acres known in the project area.

Canada thistle is the most abundant weed in the two national forests. Smaller populations of weed species pose a threat because of their ability to take over a plant community and their potential to spread. Once they become established across large areas, these species become difficult to eradicate. Also, these weed survey results likely underestimate actual weed infestations on the two national forests, since many areas have not been surveyed.

In valley bottoms or in riparian areas, the saltcedar/Siberian elm/Russian olive/bull thistle complexes are common, along with populations of bull thistle, Canada thistle and musk thistle. Wildlife species depend heavily on riparian areas in the arid Southwest, and so the weeds' ability to reduce native plant diversity has a magnified impact on the Forest's wildlife habitats. Travel corridors have the most known weeds. Weeds along roads and trails are easily surveyed, and weeds also tend to become established in disturbed areas such as rights-of-way. Bull thistle and Canada thistle are the most likely to spread, but small populations of leafy spurge found along Highways 285 and 64 near Tres Piedras also pose a threat of spread.

Away from valley bottoms, riparian areas, and main travel routes, Canada thistle, musk thistle, and bull thistle pose the largest threat of spreading because of their wide distribution. On the Jicarilla Ranger District, infestations of scotch thistle and musk thistle are found at natural gas wellheads and along roads leading to these facilities. Although the amount of scotch thistle is relatively small, the potential for spread is high because of the intermingled nature of land ownership and use in this area. Along the Rio Tusas drainage, the amount of leafy spurge is relatively small, but when the threat is seen in the context of infestations on adjacent private land, the threat increases.

On average, weeds are projected to increase annually in the United States at a rate of 8 to 12 percent per year without treatment (FICMNE 1998). Projections on the two forests predict that the spread is expected to be between 5 and 30 percent annually. The low end of this range is lower than the national average for some species based on arid Southwestern growing conditions. Saltcedar found in riparian areas is expected to increase at a slower rate, and leafy spurge would likely increase at the higher rate. For purposes of this analysis, an estimate of 8 percent per year is used in order to account for growth without overstating the estimates in the face of the variable nature of the species and other conditions.

Management Direction – Desired Condition

[No change from FEIS]

Other Direction

[Replaces entire section]

Other management direction relevant to this project includes the following:

> **Forest Service Manual 2900 – Invasive Species Management** (December 5, 2011): Specifies that management activities for invasive species will be based upon an integrated pest management approach. It prioritizes prevention, early detection and rapid response, control and management, restoration, and organizational collaboration as needed.
>
> **Executive Order 13112** (February 3, 1999): As pertains to this project, it directs Federal agencies to: … (2)(b) detect and control [invasive] species; (c) monitor population of such species; and (d) provide for restoration of native species.
>
> **"2008-2012 National Invasive Species Management Plan"** (August 1, 2008): Directs Federal efforts (including overall strategy and objectives) to prevent, control and minimize invasive species and their impacts through 2012. The plan gives Federal agencies, including the Forest Service, broad authority to prevent the spread of invasive species and authorizes them to assist State and private entities in their prevention efforts.

"USDA Forest Service National Strategy and Implementation Plan for Invasive Species Management" (USDA Forest Service, October 2004): Provides overall strategic direction for addressing invasive species. It contains four elements: prevention, early detection and rapid response, control and management, and rehabilitation and restoration.

New Mexico Executive Order 00-22 (NMEO 2000): Directs state executive agencies to manage weed infestations designated by the New Mexico Department of Agriculture as Class A weed infestations on state land rights-of-way by making use of integrated pest management techniques.

Noxious Weed Management Act (1978): The State of New Mexico enacted this legislation to recognize the adverse economic and environmental impacts of weeds and the need for action to reduce this threat.

Forest Service Manual 2150 – Pesticide-Use Management and Coordination (USDA Forest Service 2013): Provides requirements for use of pesticides (including herbicides).

Other laws, regulations and policies will be followed as they apply to the control of weeds on National Forest System lands.

Proposed Action

[Replaces 1st paragraph]

The proposed action is an integrated set of weed control actions that will control weeds with the goal of completely eliminating them. This integrated weed management approach is described in the Forest Service Manual 2900 (USDA Forest Service 2011). Proposing an integrated approach recognizes that using only one management method is not likely to be effective. For the greatest likelihood of success, flexibility is needed to address differences in site-specific conditions. The weeds proposed for treatment are any listed on the New Mexico Department of Agriculture's noxious weeds list, either at the time of this writing or listed in the future. As of this writing, 21 of the 37 listed weeds are known to occur in the two national forests, and 5 have the potential to occur. The Forest Service does not intend to treat some of the listed species, such as St. John's wort (*Hypericum perforatum*) and wild licorice (*Glycyrrhiza lepidota*), because they are medicinal plants.

[Replaces 1st paragraph, p. 29]

Treatments would begin in 2015 and would take place for at least 10 years[1]:

- Each national forest expects to treat an average of 300 to 800 acres per year (600 to 1,600 per year for both forests on average) depending on funding and methods used.
- Each national forest expects to treat no more than 1,500 acres per year (3,000 per year for both forests as a maximum).

[Replaces 4th paragraph, p. 29]

[1] The timeframe for the effects analysis in this supplement is 10 years. The forests expect to have controlled most of its weed populations by then; however, treatments are expected to be ongoing since completely preventing new introductions isn't likely.

The adaptive management approach was further defined in January 2005, when the Forest Service published planning rules that recognize the role of adaptive management in implementing forest plans:

> Adaptive management is an approach to natural resource management where actions are designed and executed and effects are monitored for the purpose of learning and adjusting future management actions, which improves the efficiency and responsiveness of management. (36 CFR 219.16, 70 FR 1060)

In 2008, Forest Service NEPA regulations at 36 CFR § 220.3 defined adaptive management as "[a] system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate management changes that will best ensure that those outcomes are met or reevaluated. Adaptive management stems from the recognition that knowledge about natural resource systems is sometimes uncertain."

[Replaces last sentence of 1st paragraph, p. 30]

This strategy is consistent with Forest Service guidelines on applying adaptive management to site-specific environmental analysis for weed management projects (USDA Forest Service 2011).

[Replaces all bullet points on p. 30]

The proposed weed control program involves the following steps:

- Inventory by searching places with a high likelihood for finding new weed populations, and enter new weed locations in the Geographic Information System database.
- Prioritize and select appropriate treatment methods based on criteria in the FEIS and this draft SEIS (chapter 2), including applicable design features based on site conditions.
- Develop an implementation plan that is reviewed and updated annually, including coordination with other agencies regarding weed control activities.
- Complete any needed heritage, plant, and wildlife surveys.
- Complete any needed permits (chapter 2).
- Notify the public about the annual weed treatment schedule and site-specific locations.
- Implement weed control treatments.
- Monitor for:
    - ♦ treatment effectiveness in meeting weed control objectives;
    - ♦ effects on other resources relative to those predicted in the FEIS and this supplemental EIS; and
    - ♦ implementation and effectiveness of design features used to minimize adverse impacts.
- Evaluate and document monitoring results for use in future weed treatment prescriptions.

Forest Plan Amendment

[Replaces entire section]

Alternatives B and D include a nonsignificant, programmatic amendment to the Santa Fe National Forest Plan. The amendment would allow the use of herbicides in places currently prohibited by forest plan standards and guidelines. These areas are in municipal watersheds and on soils with low revegetation potential. Chapter 2 provides the exact language of the proposed amendment. The Carson National Forest Plan does not prohibit the use of herbicides in any specific areas.

Decision-making Framework

[Replaces "EIS" with "SEIS." Adds this paragraph]

The incorporation of the amendment will be conducted through use of the 1982 rule procedures as allowed by the transition language of the 2012 planning rule (36 CFR 219.17(b)(3)).

The predecisional administrative review process (known as the objection process[2]) required for the project will also be used for administrative review of the proposed amendment for the selected alternative (36 CFR 219.59(b)).

Public Involvement

[Replaces entire section]

Collaboration and Scoping

In 1996 and 1997, the Forest Service met informally with other Federal, State and county agencies to discuss the threat of weeds and coordinate treatments. Newspaper articles were also published to inform the public about the threat of weeds and the full range of treatment options, such as those being considered by the Forest Service. In 1998, the two national forests began scoping for this project, starting with public meetings held in Taos and Espanola. In March 2000, a scoping letter was sent to approximately 450 individuals, agencies, tribes and organized groups to inform them about the weed control treatment proposals. At that time, each forest was independently working on separate environmental assessments for forestwide weed control projects. As a result of the March 2000 scoping, a decision was made to combine the efforts of the two national forests and document the analysis in an EIS.

In December 2000, the Forest Service sent a new scoping letter to the public about the proposed action. On December 15, 2000, the Forest Service published a notice of intent to prepare an EIS in the Federal Register. At the request of local citizens, a field trip was conducted to discuss weed infestations and show people the weed conditions on the Tres Piedras Ranger District.

The Forest Service first contacted tribal governments about treating weeds in 1999. They included the tribal governments in their March and December 2000 scoping efforts. In December 2003, the Forest Service sent another letter to all potentially affected tribal governments to initiate consultation and solicit their comments about the proposed project.

A total of 34 individuals and 30 organizations commented during scoping. The largest number of comments questioned the need for treatment when other solutions, such as eliminating grazing

[2] See 36 CFR 218, Final Rule for Project-level Predecisional Administrative Review Process

and closing roads (which they considered to be the source of weeds), were available. Education was also suggested as a means of dealing with the weed problem. For some respondents, education was suggested as a substitute for treatment, and for others it was presented as a complementary activity.

The treatment that appeared to be of greatest concern to those who commented was the use of herbicides. Most opposition was based on concerns that herbicides could adversely impact human health, nontarget plants, and wildlife. Concerns over the impact to water quality and fish were also mentioned. Some respondents voiced concerns that herbicides were too nonselective and their impacts would be too broad. Potential impacts to people with multiple chemical sensitivities were mentioned as reason to avoid using herbicides and any associated chemicals (e.g., inert ingredients in the formulations). Suggestions were made to use a wide variety of nonchemical methods, such as hand digging (possibly enlisting volunteers to do this work) and using goats to graze the weeds where possible. In addition to the letters responding to the scoping letters, a petition with approximately 1,000 signatures was submitted stating opposition to the use of herbicides in managing weeds on the Carson National Forest.

One comment also raised concerns with using biological agents because of the possibility of introducing an insect that would have unforeseen effects, such as getting out of control itself.

Others stated that chemicals might be used under controlled conditions so that people who use the two national forests to collect and use certain products would not be adversely impacted from herbicides, or that other methods would not destroy these culturally and economically important plants.

Another set of comments supported the need to treat weeds and supported use of the integrated approach (including herbicides), as long as appropriate oversight is given to the efforts so they are coordinated within the two national forests and with other agencies conducting similar efforts. Some comments in this set also noted that strong monitoring should be a priority to be successful.

Using the comments sent during scoping, the Forest Service’s interdisciplinary team identified four significant issues (see “Issues” section). The team then created alternatives C and D to respond to these issues. In May 2004, a four-page update was mailed to known interested or affected parties. It described the final issues and alternatives, as well as the status of the draft EIS and estimated release date.

Public Comment on the Draft Environmental Impact Statement

On July 16, 2004, the Forest Service published a notice of availability of the DEIS in the Federal Register. The legal notices announcing the start of the 45-day comment period were published in the newspapers of record on July 22, 2004. The Forest Service received 106 letters on the DEIS; of these, 7 were received after the end of the comment period, which was August 30, 2004.

The Forest Service’s interdisciplinary team identified approximately 750 individual comments contained in the letters. As with scoping, the use of herbicides continued to be a main concern among members of the public. In response, the final environmental impact statement (FEIS) clarified and expanded upon its discussion of the risks associated with the use of herbicides (see appendix 3 of the FEIS). Appendix 9 of the FEIS responds to comments received on the DEIS. Other relevant comments were incorporated into the FEIS.

Appeal of the Record of Decision

On September 12, 2005, the Carson and Santa Fe National Forest Supervisors signed a record of decision selecting alternative B. The Forest Service published the notice of availability of the FEIS and record of decision in the Federal Register on November 18, 2005. The legal notices announcing the start of the 45-day appeal period were published in the newspapers of record on November 23, 2005. Eight appeals of the decision were submitted. The Forest Service met with the appellants, but was unable to resolve the issues stated. The Deputy Regional Forester reversed the decision on February 23, 2006.

Draft Supplemental Environmental Impact Statement (draft SEIS)

The Forest Service has prepared this draft SEIS to correct the deficiencies identified by the Deputy Regional Forester and to update the analysis and facts where needed pursuant to 40 CFR 1502.9(c)(1). In accordance with the Council of Environmental Quality (CEQ) regulations at §1502.9(c)(4), this draft SEIS shall be “prepare(d), circulate(d), and file(d) … in the same fashion (exclusive of scoping) as a draft and final statement.” This means that the project will not be re-scoped, but the public will have the opportunity to comment on this draft SEIS before a final decision is made.

In February 2012, the Forest Service sent postcards to 274 people and organizations anticipating the draft SEIS would be published that spring, and asking them how they would like to be notified. We received 17 responses.

The Forest Service has published regulations that institute an objection process in lieu of the appeal process. This project and its decision will fall under the objection process, whose regulations are found at 36 CFR 218.

Issues

[Add this sentence to first paragraph; otherwise no change from FEIS]

For this draft SEIS, the responsible officials have retained the four significant issues from the FEIS. The analysis of the public’s comments conducted in 2004 remains valid.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

[No change from FEIS]

Alternatives Considered but Eliminated from Detailed Study

[Add to end of section “Aerial Herbicide Application”]

Current Forest Service regulations require that aerial applications (e.g., from a helicopter or an airplane) be analyzed in an EIS specifically about aerial applications. As a result, this alternative is outside the scope of this EIS.

[Add sentences to end of section “Organic Treatment Methods”]

The Carson National Forest has inexpensively and effectively used plastic sheeting to cover and eradicate weeds on areas less than ¼ of an acre. The drawbacks to this method are its unsightliness and that it also killed native plants, leaving bare ground. Nonetheless, organic methods, when shown to be effective and to meet the criteria of the adaptive strategy in the FEIS, may be used by the two national forests.

Alternatives Considered in Detail

Alternative A

No Action

[Replaces entire section]

Under the no-action alternative, this project would not occur. This means neither forest would have an integrated, forestwide approach to managing weeds. Previously approved, project-specific weed treatments, such as those along the lower Jemez River, would be implemented, along with those of other jurisdictions within the national forest boundaries, such as along Federal, State and county roads. Weed inventories and prevention activities would continue to occur.

Alternative B - Proposed Action (Integrated Strategy)

[Additional paragraph]

The known weed populations have a footprint of 13,256 acres. This is a snapshot in time, and is not the extent of the proposed treatments. The proposed action would treat existing weeds and new populations as they are discovered. Any new populations to be treated must be on New Mexico Department of Agriculture’s weed list and must follow the adaptive management strategy described in chapter 2.

[Remove figure 3 and refer to figure S-2]

Figure S-2 on page 7 shows the locations of the known weed populations. Appendix 7 shows how each species would be treated.

[New photo]

Photo 2. Hand-grubbed patch of bull thistle (Santa Fe National Forest photo)

[Replaces first two sentences of second paragraph of section under "Herbicides"]

Thirteen herbicides are proposed for use: 2,4-D, aminopyralid, clopyralid, chlorsulfuron, dicamba, glyphosate, hexazinone, imazapic, imazapyr, metsulfuron, sulfometuron, picloram, and triclopyr. The herbicide aminopyralid has been added as a proposed herbicide in this draft SEIS; the others were proposed and analyzed in the FEIS. Appendix 3 contains detailed information about each. Treatments using the herbicides are tailored to specific species and site conditions.

[Replaces entire section under "Mechanical"]

Mechanical control methods include actions such as mowing, girdling, or root tilling. Mowing cuts plants off above ground. Root tilling digs into the soil to unearth the roots. Girdling is a method that may be used for invasive trees, such as Siberian elm (photo 3).

Photo 3. Girdled trees (photo courtesy of Tom Kaye, Institute for Applied Ecology)

Mowing and root tilling employ large mechanized equipment such as tractors with specially designed attachments. These methods have not been demonstrated to be effective in eradicating or substantially reducing weed infestations, and typically require frequent repeat treatments. They do reduce plant and root vigor. Feasibility for these two methods is also quite limited on the two national forests due to the steep slopes and other common terrain features such as trees, boulders or logs. Thus, this method is only likely to be for minor, incidental use, mainly along highways in conjunction with ongoing road maintenance actions. Most mechanical treatment is proposed in combination with another method.

[Replaces table 6]

The abbreviations shown below represent the kinds of treatments proposed in the action alternatives.

Treatment Method	Abbreviation
Biological	BIO
Grazing	GR
Herbicides	HE
Manual	MA
Mechanical	ME
Prescribed fire	FR

Table S-7. Summary of treatments proposed for alternative B

Treatment	Acres	Percent of total
BIO, FR, GR, HE, MA, ME	4	0.03
BIO, FR, HE, ME	181	1
BIO, GR, HE	21	0.2
BIO, GR, HE, MA	1	0.005
BIO, GR, HE, MA, ME	16	0.1
BIO, GR, HE, ME	43	0.3
BIO, HE, MA	22	0.2
BIO, HE, MA, ME	4,052	31
BIO, HE, ME	400	3
FR, GR, HE, MA, ME	73	1
FR, GR, HE, ME	0	0.0003
FR, HE, MA, ME	14	0.1
FR, HE, ME	617	5
GR, HE, MA, ME	2,682	20
GR, HE, ME	2,999	23
HE, MA	497	4
HE, MA, ME	1,629	12
HE, ME	3	0.02
Grand Total	**13,256**	

Alternative C – No Herbicides

[Additional paragraph]

The known weed populations have a footprint of 13,256 acres. This is a snapshot in time, and is not the extent of the proposed treatments. Alternative C would treat existing weeds and new populations as they are discovered. Any new populations to be treated must be on New Mexico Department of Agriculture's weed list and must follow the adaptive management strategy described in chapter 2.

[Remove figure 4 and refer to figure S-2]

Figure S-2 shows the locations of the known species of weed populations. Appendix 7 shows the method by which each species could be treated. Refer to page 17 for a key of abbreviations.

[Replaces table 7]

Table S-8. Summary of treatments proposed for alternative C

Treatment	Acres	Percent of Total
BIO	12	0.09
BIO, FR, GR, MA, ME	4	0.0
BIO, FR, ME	181	1.4
BIO, GR	9	0.067
BIO, GR, MA, ME	16	0.1
BIO, GR, ME	43	0.3
BIO, MA	23	0.2
BIO, MA, ME	4,052	31.0
BIO, ME	400	3.0
FR, GR, MA, ME	73	1.0
FR, GR, ME	0	0.0003
FR, MA, ME	14	0.1
FR, ME	617	5.0
GR, MA, ME	2,682	20.0
GR, ME	2,999	23.0
MA	497	4.0
MA, ME	1,629	12.0
ME	3	0.02
Grand Total	**13,256**	

Alternative D – Herbicides Only

[Additional Paragraph]

The known weed populations have a footprint of 13,256 acres. This is a snapshot in time, and is not the extent of the proposed treatments. The proposed action would treat existing weeds and new populations as they are discovered. Any new populations to be treated must be on New

Mexico Department of Agriculture's weed list and must follow the adaptive management strategy described in chapter 2.

[Remove figure 5 and refer to figure S-2]

Figure S-2 on page 7 shows the locations of the known weed populations. Appendix 7 shows how each species would be treated.

[Replaces table 8]

Table S-9. Summary of treatments proposed for alternative D

Treatment	Acres	Percent of Total
Herbicide	13,256	100
Total	**13,256**	

Adaptive Strategy – All Action Alternatives

[No change from FEIS]

Treatment Objectives, Priorities, and Decision Criteria

[No change from FEIS]

Additional Criteria for Prioritizing and Determining Objectives and Methods

[No change from FEIS]

[Replaces table 9]

Table S-10. Additional treatment criteria and limitations

Weed Site Conditions	Treatment Method Limitations
Area of high human use such as a recreation site, administrative site or area where people often collect plants.	Method(s) must have been documented to be low risk of causing harm to people. Examples include nonherbicide methods with lowest risk (e.g., those that avoid burning) or herbicide formulations/application methods having the lowest risk of harmful effects to humans (for example, aminopyralid, glyphosate, imazapyr, imazapic, metsulfuron methyl, clopyralid products would be available for use per risk assessment results found in appendix 3). Also adhere to other design features that apply to protection of human health and safety (e.g., notification). Use of herbicides shall occur during weekdays only.
Area where there is a shallow water table (no more than 6 feet deep) and soil with a high permeability rate, where there may be a risk of an herbicide leaching through the soil to the groundwater.	Nonherbicide method(s) appropriate for the site conditions (manual pulling or mowing), or an herbicide appropriately labeled for use in these locations (e.g., short-lived, nonleachable herbicides such as glyphosate, imazapic, imazapyr, metsulfuron methyl, clopyralid, chlorsulfuron) that has been registered by the EPA for use on permeable soils with shallow water tables. Herbicides that use picloram as their active ingredient (e.g., Tordon 22K) would not be used in these situations per risk assessment results). Also adhere to design features that apply to protection of soil and groundwater resources.

Weed Site Conditions	Treatment Method Limitations
In riparian areas, including Outstanding National Resource Waters, or next to live water bodies containing aquatic species.	Method(s) determined and documented to have low risk to fish or other aquatic species. Examples include a nonherbicide method (e.g., mowing) that avoids erosion/sediment production or herbicides registered by the EPA for aquatic habitats (e.g., chlorsulfuron, glyphosate formulations such as Rodeo (which does not use the surfactant POEA), imazapic, imazapyr). Also adhere to design features that apply to protection of riparian, water and aquatic resources.
Threatened, endangered or sensitive plant species are present.	Method(s) determined and documented to have low risk to native plant species, such as nonherbicide methods (hand pulling) with appropriate disturbance controls. Herbicide applications include spot treatment (by hand or backpack spray) that avoid vehicle boom spray application of herbicides such as imazapyr, imazapic clopyralid, chlorsulfuron, because they have high potential to affect nontarget plants up to several hundred feet away. Herbicides, if used from boom spray, could be used if risk ratings are similar to 2,4-D, which has low risk of impact beyond 25 feet of drift. For Holy Ghost ipomopsis, see specific design features later in this section. Adhere to design features that apply to protecting threatened, endangered or sensitive plant species, including limitations on herbicide spraying from vehicles.
Occupied threatened, endangered or sensitive wildlife species habitat.	Method(s) used must have been determined to have low risk to wildlife species. These methods include nonherbicide methods at the proper timing (e.g., burning outside seasonal restrictions). Herbicide applications must be shown to be below the level of concern through specific risk assessment for the herbicide used when applied in these habitats (see appendix 3). No direct application of herbicides to water would be permitted under the adaptive strategy even where formulations are registered for such use (e.g., AquaKleen formulation of 2,4-D). This restriction is imposed because of possible effects of direct application to Rio Grande cutthroat trout. Also adhere to other design features that apply to protection of threatened, endangered or sensitive wildlife species.
Wilderness and designated nonmotorized areas.	Motorized vehicles and mechanized equipment are prohibited in all wilderness areas. In the Pecos Wilderness, sheep or goat grazing for weed control would continue to be prohibited by an existing closure order. In other locations of Rocky Mountain bighorn sheep habitat, controlled grazing for weed control would also be prohibited. See design features.
Santa Fe and Gallinas Municipal Watersheds in the Santa Fe National Forest	Method(s) must have been documented to be low risk of causing harm to people. Examples include nonherbicide methods with lowest risk (e.g., those that avoid burning) or herbicide formulations/application methods having the lowest risk of harmful effects to humans (for example, aminopyralid, glyphosate, imazapyr, imazapic, metsulfuron methyl, clopyralid products would be available for use per risk assessment results found in appendix 3). Also adhere to other design features that apply to protection of human health and safety (e.g., notification). Method(s) used must be approved by the appropriate officials of the cities of Santa Fe and Las Vegas, New Mexico.

Design Features and Monitoring Requirements

[Replaces table 10]

Table S-11. Design features and monitoring requirements for all alternatives

Row No.	Description of Design Feature and Monitoring Requirement	Alternatives
	Human Health and Safety	
1	Herbicide formulations (specific products including mixtures) will not be used unless they have been registered for use by the EPA and all EPA label requirements (including limitations) are strictly followed. Only herbicides with a completed risk assessment per Forest Service standards would be used.	B, D
2	In areas of human habitation or high use such as a recreation site, administrative site or area where people often collect plants, the treatment method must have low risk of harmful effects to humans. Examples include nonherbicide methods (manual/mechanical/grazing) or herbicides rated as having the lowest risk of harmful effects to humans (see appendix 3).	B, D
3	Herbicide application will strictly adhere to EPA label instructions regarding temperature, humidity, wind speed and other weather variables, to avoid spray drift to nontarget plants or other resources while increasing treatment effectiveness.	B, D
4	Herbicide use will be restricted to EPA-registered application rates (usually in terms of pound per acre of active ingredient applied) and conditions listed on the label. Followup application of a second herbicide to an area should be conducted only after reviewing best available information on compatibility with the previous application's formulation.	B, D
5	Herbicides may only be applied by a trained applicator under supervision of a licensed applicator, in accordance with Forest Service directives.	B, D
6	Herbicide use will comply with the direction contained in Chapter 2150 of FSM 2100 - Environmental Management (USDA Forest Service 1998a), including the requirement that a pesticide use proposal (form FS-2100-2) be completed for all proposed pesticide (i.e., herbicide) uses on National Forest System lands.	B, D
7	Herbicide applicators will have the chemical spill plan and emergency cleanup kit onsite during treatments. The spill plan identifies methods to avoid accidental spills as well as how to report and clean up spills. The kit will contain appropriate spill cleanup supplies (see appendix 6).[3]	B, D
8	Workers handling herbicides will be required to wear protective clothing, including a long-sleeved shirt and long pants to reduce worker doses. For herbicides containing hexazinone, respiratory protection would also be required per label direction. Clothes should be cleaned daily. Workers will also wear waterproofed boots, gloves, and other safety clothing and equipment listed on the herbicide label. Workers mixing or loading herbicides will be required to wear eye protection (goggles or eye shields) and Tyvek suits or herbicide-resistant aprons.	B, D
9	A pesticide application record (PAR) will be completed on a daily basis for each project area detailing the herbicide application, treatment area, target species distribution and density, weather conditions, and recommendations for followup treatments or rehabilitation.	B, D

[3] A comment on the DEIS submitted in 2004 by the New Mexico Environment Department states that in the event of spills, the Ground Water Quality Bureau Chief must be notified. This requirement is listed in Appendix 6 on page 295 under "Major Spills".

Row No.	Description of Design Feature and Monitoring Requirement	Alternatives
10	The Forest Service will provide public information about weed treatments using herbicides, including herbicide to be used, locations, application schedules, and so forth. This information will be posted on the Santa Fe and Carson National Forest Internet Web sites and mailed to those who request it.	B, D
11	To further notify forest visitors and users, signs regarding herbicide use will be placed at access points to treatment areas prior to herbicide application. Signs will include the herbicide to be used, effective dates, and phone number for obtaining more information.	B, D
12	Traffic control and signing during weed treatment operations will be used as necessary to ensure safety of workers and the public. Recreation sites, roads, trails or other areas scheduled for treatment may be temporarily closed during weed treatment activities to ensure public safety.	B, C, D
13	Weed treatments will be coordinated with potentially affected adjacent landowners and range allotment permittees. Cooperative efforts on adjacent lands and range allotments would increase treatment effectiveness and the ability to meet weed control objectives.	B, C, D
14	In highly used developed recreation areas, use of herbicides would occur during weekdays only.	
	Native Vegetation and Treatment Effectiveness	
15	Prescribed burning, digging, pulling, and tilling weeds, and other ground-disturbing activities will be designed to avoid or minimize impacts to native plants of cultural and traditional concerns. Prior to implementation, a Forest Service biologist or other qualified person will locate these plants to the extent possible.	B, C, D
16	Allotment permittees will be contacted about upcoming treatments (methods, locations, schedules, and so forth) that may affect their grazing operations. Annual operating instructions may be adjusted as needed. Early coordination will minimize the impact of adjusting grazing operations during and after treatments, the extent and duration of which will be determined by site-specific conditions and weed treatment objectives.	B, C, D
17	Weed treatments will only be applied where weeds actually exist, not on areas with a potential for weed infestations.	B, C, D
18	Vehicles used for weed treatments will be properly cleaned prior to entering National Forest System lands and again before leaving the treated area to avoid further spread of weeds.	B, C, D
19	Where treatments result in exposing bare mineral soil, those sites will be evaluated to determine the need for revegetation (seeding, planting), mulching, or other erosion or sediment control measures. The evaluation would consider the potential for subsequent reinvasion by weed species, potential for erosion, water runoff, and stream sedimentation. Where seeding is used, certified weed-free seed will be required. Seed mixes will be based on site-specific conditions and objectives. Treatment combined with reseeding has been shown to be effective at controlling weeds (Endress et al. 2012).	B, C, D
20	Herbicides will not be applied if snow or ice covers the target weed plants, to avoid runoff into soil and onto nontarget vegetation.	B, D
21	After treatment, livestock grazing will be deferred where needed to achieve weed treatment objectives, based on site-specific conditions. This will be accomplished by working with permittees and adjusting their annual operating instructions as necessary.	B, C, D
22	Biological agents will not be released until screened for host plant specificity and approved by the USDA Animal Plant Health Inspection Service and New Mexico Department of Agriculture.	B, C

Row No.	Description of Design Feature and Monitoring Requirement	Alternatives
23	All weeds that are mechanically or hand excavated after flower bud stage will be double bagged and properly disposed of at an approved facility (e.g., covered landfill).	B, C
24	Use of prescribed fire must adhere to restrictions contained in the forest plan and Forest Service directives, such as those for using fire within wilderness (Forest Service Manuals 2324.2 and 2324.04(b)), requirements for detailed burn prescriptions, and other requirements intended to avoid unexpected consequences.	B, C
	Threatened, Endangered and Sensitive Plants	
25	The Santa Fe National Forest or Pecos-Las Vegas Ranger District will coordinate with the New Mexico Environment Department (NMED) and U.S. Fish and Wildlife Service to obtain the most current survey information on the Holy Ghost ipomopsis prior to implementing any weed treatments in occupied Holy Ghost ipomopsis habitat.	B, C, D
26	Ground-disturbing activities such as tilling, pulling, digging up weeds will be designed to avoid trampling or other direct impacts to individual Holy Ghost ipomopsis plants or other threatened, endangered and sensitive plants.	B, C
27	Herbicide use is prohibited within and for 25 feet around Holy Ghost ipomopsis plants and occupied habitat; only hand removal by pulling or digging up weeds will be permitted. From 25 to 50 feet, only hand application of herbicides by wick or rag will be permitted.	B, D
28	Prior to implementing any controlled grazing, spray application of herbicides, mechanical (e.g., mowing), or prescribed fire treatments within Holy Ghost ipomopsis or other sensitive plant species habitats, a Forest Service biologist or other qualified person will visibly mark a 50-foot buffer around groups or isolated individuals of the subject plants.	B, C, D
29	Within and for 25 feet around other sensitive plants occupied habitats, only hand treatments will be permitted (i.e., wick or rag to apply herbicides; shovel to dig up weeds); no spray herbicide application will be permitted.	B, C, D
30	A Forest Service biologist or other qualified person will be present during any ground-disturbing activity within Holy Ghost ipomopsis and other sensitive plant species occupied habitats.	B, C, D
31	Where Holy Ghost ipomopsis or other sensitive plant roots may be intermingled with weed roots, a Forest Service biologist or other qualified person will determine how to safely remove the weed(s).	B, C, D
32	Herbicide use proposals within any threatened, endangered or sensitive plant species potential habitat will require a survey of that habitat, if possible. If no survey is conducted, the potential habitat will be treated as if occupied by the threatened, endangered or sensitive plant and all applicable occupied habitat design features will apply.	B, D
	Wildlife, including Threatened, Endangered and Sensitive Species	
33	For treatment areas exceeding 1 acre within threatened, endangered or sensitive species wildlife habitat, surveys for the species will be conducted prior to implementation. If surveys are not conducted prior to implementation, that area will be treated as if occupied. Within occupied threatened, endangered or sensitive species habitats, loud, persistent noise disturbances or modifications of breeding habitat features will be avoided. If a potentially adverse effect cannot be avoided, prepare a supplemental biological assessment and consult with U.S. Fish and Wildlife Service to determine the appropriate design features.	B, C, D
34	For occupied Mexican spotted owl and Southwestern willow flycatcher habitat, applicable breeding season restrictions will be implemented as specified in forest plans and U.S. Fish and Wildlife Service recovery plans for those species.	B, C, D

Row No.	Description of Design Feature and Monitoring Requirement	Alternatives
35	In areas that have suitable habitat for wintering bald eagles and where weed treatments are proposed during that period (winter months through March), a presence/absence survey must be completed within a 0.5-mile radius of the work site before any work can begin and following any breaks of more than 10 days. If an eagle is present within the 0.5-mile radius, work will stop until the bird leaves of its own volition or if, in consultation with the U.S. Fish and Wildlife Service, a Forest Service biologist determines that the potential for harassment is minimal. If bald eagles nest on national forest land within 0.5-mile of areas planned for treatment, the U.S. Fish and Wildlife Service will be contacted to determine what additional consultation may be needed.	B, C, D
36	Survey to protocol must be completed for all treatment units within Southwestern willow flycatcher occupied habitat (Carson National Forest) before treatment can begin, if the timing of treatment coincides with dates birds are likely to be present in the area. If the flycatcher is found, no treatments can occur; if the flycatcher is not found, treatment can proceed.	B, C, D
37	No prescribed burns will be done within Mexican spotted owl protected activity centers. Treatments will be done by hand pulling, grubbing, or herbicide application during part of the breeding season (early June to mid-July) to be effective. Treatments will be short duration, low-disturbance activities that would occur once or twice in a season (depending on size of the treatment area). A biologist can accompany applicators to monitor any owl activity that might occur. A year after treatment, monitoring would be done for any reoccurrence of the weed.	B, C
38	In areas proposed for treatment occupied by Forest Service sensitive wildlife species, and where individuals in the population may be impacted, a Forest Service biologist will prescribe design features to avoid or minimize the impacts to individuals, while continuing to maintain population viability and avoid a trend toward Federal listing.	B, C, D
39	Only herbicides documented to have a low risk to wildlife and domestic animals (for both ingredients and application rates) will be used.	B, D
40	No controlled grazing with sheep or goats will be permitted in areas occupied or frequented by bighorn sheep (high country/wilderness).	B, C
41	No weed treatments will occur in Jemez Mountain salamander habitat during the late summer monsoon season when salamanders are above ground. In areas receiving 5 consecutive days of rain, treatments will be stopped until a Forest Service biologist or other qualified person determines that the surface has dried sufficiently to resume treatment.	B, C, D
42	No herbicide or soil-disturbing treatments, including controlled grazing, will occur within 50 feet of Rio Grande cutthroat trout occupied streams between June 1 and June 30 (spawning season).	
	Air, Soil, Water, Riparian, Fish and Other Aquatic Resources	
43	All prescribed burning must comply with the New Mexico smoke management requirements (permitting, monitoring, and so forth) to maintain levels of these emissions within State and Federal air quality standards.	B, C
44	Heavy mechanized equipment such as tractors with tillers or mowers will not be used on slopes over 40 percent, to minimize erosion potential.	B, C
45	Heavy equipment will not be used to mechanically dig up weeds within riparian zones unless a Forest Service soil, water or fisheries specialist examines the site- specific conditions and determines that there would be no adverse impacts to water quality, stream morphology or aquatic resources.	B, C

Row No.	Description of Design Feature and Monitoring Requirement	Alternatives
46	Herbicides used within 25 feet of a waterbody, or within riparian or other areas with a shallow water table, will be restricted to hand application of a short-lived, nonleachable herbicide that has been registered by the EPA for use on permeable soils, near water, or in areas having shallow water tables (e.g., 2,4-D, fluridone, glyphosate, triclopyr). Herbicides that use picloram as their active ingredient (e.g., Tordon 22K) will not be used in these locations or within the municipal watersheds of the Gallinas and Santa Fe Rivers. A Forest Service soil, water or fisheries specialist, or other qualified person will verify and map, and if necessary, visibly mark these areas.	B, D
47	Herbicide application within a riparian area or 50 feet from a waterbody is limited to hand application onto individual weed plants (using backpack spray wand, or glove, wick, or rag). Backpack spray application upwind of surface water or when precipitation is likely will be avoided. If necessary, a Forest Service soil, water or fisheries specialist, or other qualified person will visibly mark these areas prior to implementation.	B, D
48	Mixing, pouring, loading, or transferring herbicides (even small amounts) will not occur within 200 feet of open water, and will comply with the approved chemical handling, and spill prevention and containment plan (see appendix 6). In the event of a spill of sufficient quantity that would reasonably injure or be detrimental to human health, animal or plant life, or property, the Forest Service will contact the New Mexico Environment Department Ground Water Quality Bureau chief and Surface Water Quality Bureau chief.	B, D
49	In riparian areas or next to live waterbodies containing fish, methods used must have been documented to have low risk to aquatic species.	B, C, D
50	Prescribed burning in riparian areas will be incidental to the primary activity (e.g., pile burning slash from mechanical treatment of woody invasive species). No broadcast burning will be permitted in riparian areas solely for the purpose of treating weeds.	B, C
	Heritage Resources	
51	Adhere to “Appendix F - Standard Consultation Protocol for Noxious Weed Control” of the First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities, including conducting pre-implementation heritage inventories and evaluations, applying appropriate design features to avoid adverse impacts, consulting with the State Historic Preservation Office and tribes, and monitoring treatment activities for effects to cultural resources.	B, C, D
52	Ground-disturbing activities will be designed to avoid direct impacts to cultural resource sites. Root tilling, mowing, hand pulling, digging or other weed treatments that disturb the soil beyond an aggregate of one meter square will require heritage inventory, evaluation, and consultation with the State Historic Preservation Office and tribes. Follow the protection measures specified under stipulation 6 in appendix F of the Protocol.	B, C
53	No herbicides will be applied from vehicles within 25 feet of cultural resources consisting of perishable materials with analytic or informational value, including wood, organic ceramic paints, datable materials, and residues on artifacts. Within 25 feet of such cultural resources, herbicides must be applied by hand to individual weeds to avoid getting herbicides or carrier fluids onto those remains. Prior to implementation, a Forest Service archaeologist or other qualified person will mark areas for hand application or avoidance.	B, D
54	Apply the design features listed previously under Native Vegetation and Threatened, Endangered and Sensitive Plants to minimize potential harm to plants of ethnographic concern and native plants.	B, C, D

Row No.	Description of Design Feature and Monitoring Requirement	Alternatives
55	Notification of tribes and other traditional use groups will occur before herbicides are used to inform them of pending chemical treatment activities and schedules. This measure will reduce the risk to native plants used for traditional cultural purposes and the risk to the health of individuals who gather these plants.	B, C, D
56	Sheep or goat grazing will not be used on heritage resource sites easily damaged by trampling as identified through heritage resource inventories prior to implementation.	B, C
57	Conduct fuel assessments and remove fuels from around cultural resource sites with perishable materials before prescribed burning or avoid burning around sites with perishable materials altogether. Use burn prescriptions that ensure low temperature, intensity, duration, and residence time on sites that fire will burn through.	B, C
	Municipal Watersheds	
58	Weed treatments within the Santa Fe and Gallinas municipal watersheds will be agreed to and coordinated with the appropriate officials for the cities of Santa Fe and Las Vegas, respectively. Proposed use of herbicides within these municipal watersheds would occur only upon agreement from officials of these cities.	B, C, D
	Monitoring and Adaptive Management	
59	Weed inventories and mapping will be conducted annually, and treatment of newly found populations will be identified and prioritized based on criteria in the “Adaptive Strategy” section of this chapter.	B, C, D
60	Treated sites will be monitored, evaluated, and the results documented to determine: - Effectiveness of the method(s) used in meeting the objective; - Whether impacts to resources or people were within the scope of predictions; and - Implementation and effectiveness of design features, and whether mitigations should be modified or added to enhance effectiveness.	B, C, D
61	Changes in prescriptions made as a result of monitoring and evaluation, and treatments for newly found weed populations must comply with all design features and monitoring requirements in the EIS. The actions and effects must be within the scope of those considered in the EIS. New actions or effects outside of those considered in this EIS will be analyzed in accordance with FSH 1909.15, Chap. 10, Sec. 18, to determine the whether additional environmental analysis under NEPA is required.	B, C, D

Forest Plan Amendment

[Additional paragraphs]

The incorporation of the amendment will be conducted through use of the 1982 rule procedures as allowed by the transition language of the 2012 planning rule (36 CFR 219.17(b)(3)).

As stated on page 12, the predecisional administrative review (objection) process employed for the project will also be used for administrative review of the proposed amendment for the selected alternative (36 CFR 219.59(b)).

[Replaces table 11]

Table S-12. Proposed amendment to the Santa Fe National Forest Plan (pp. 75-76)

Existing Forest Plan Direction	Proposed Forest Plan Direction (bold text shows new language)
5. Chemical treatments may be applied:	5. Chemical treatments may be applied:
a. when determined through an environmental analysis to be environmentally, economically, and socially acceptable.	a. when determined through an environmental analysis to have **no adverse environmental, economic, or social impacts for longer than 6 months.**
b. on areas outside municipal watersheds and human habitation.	b. **within** municipal watersheds **only when the municipality concurs with the proposed treatment and design features.**[4]
c. on soils with moderate or high revegetation potential.	c. **on any soil provided that soil erosion on that site is not increased to above the tolerance level identified in the terrestrial ecosystem survey for the affected soil unit.**
d. on areas that would benefit from selective control of plant species.	d. on areas that would benefit from selective control of plant species.
e. on areas where the chemicals will not violate State water quality standards.	e. on areas where the chemicals will not violate State water quality standards.
f. on soils with moderate to high cation exchange capacity.	f. **In areas of** human habitation: • **Apply this adaptive strategy identified in the EIS in Table S-10: Method(s) must have been documented to be low risk of causing harm to people.** • **Apply the design features listed in the EIS in Table S-11 under "Human Health/Safety and General Mitigations."**
g. on piñon-juniper retreatment areas on stands where 80 percent of the trees are less than 6 feet in height, with more than 25 trees per acre.	g. on piñon-juniper retreatment areas on stands where 80 percent of the trees are less than 6 feet in height, with more than 25 trees per acre.

[4] In a 2004 comment on the DEIS, the New Mexico Environment Department suggested that the Forest Service may wish to "retain the prohibition on application of certain higher risk herbicides, such as picloram [in municipal watersheds]." The agency believes that retaining flexibility in weed treatments is crucial to the success of this project. The design features listed in table S-11 (such as rows 1, 4, and 46 to 49) and the requirement to obtain the concurrence of the municipality ensure the safety of the application method.

Permits and Authorizations Required

[Replaces entire section]

- Consult and obtain concurrence from the U.S. Fish and Wildlife Service on the Forest Service's biological assessment and determinations of effects to threatened or endangered species. This will occur prior to signing a record of decision authorizing project implementation.
- Consult and obtain concurrence from the New Mexico State Historic Preservation Officer regarding identification, evaluation, and determination of effects of the project on heritage resources. Final consultation and concurrence from the State Historic Preservation Office will occur prior to implementation.
- Obtain concurrence from USDA Animal and Plant Health Inspection Service (APHIS) and the State of New Mexico for any biological control method to be used.
- Forest Service employees or contractors supervising application of herbicides must first be certified by New Mexico Department of Agriculture (NMDA). Herbicide application must comply with all pre- and post-implementation requirements in Forest Service Manuals 2900 and 2150 regarding weed management and coordination with other agencies.
- Following Forest Service policy and procedures, regional forester review and approval must be obtained before using herbicides in wilderness, and any other situations as directed.
- Comply with the New Mexico Pesticide Control Act governing public applicators, record keeping, and other requirements.
- Prior to burning, a burn plan must be prepared and burn permit obtained from New Mexico Environmental Department, Air Quality Bureau.
- Obtain a permit for any discharge of pesticides into "Surface Waters of the United States" as required by EPA's National Pollutant Discharge Elimination System (NPDES) authorized under the Clean Water Act.
- Comply with the NPDES Interim Guidance (January 9, 2012) and any future Regional Guidance (as issued) governing compliance with EPA's Pesticide General Permit (PGP) under the Clean Water Act.
- Comply with the anti-degradation policy of the New Mexico Environment Department governing protection of water quality in designated Tier 3 waters (Outstanding National Resource Waters) under the Clean Water Act.[5] Consult with and obtain concurrence from the New Mexico Environment Department Surface Water Quality Bureau regarding any treatments that could result in short-term degradation to the chemical, physical or biological integrity of these waters.

Comparison of Alternatives

[Replaces entire section]

[5] http://www.nmenv.state.nm.us/swqb/onrw/

This section provides a comparative summary of the alternative treatments and effects of implementing each alternative. Information is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Likely the most important consequence of any of the action alternatives (alternatives B, C, and D) would be preventing the spread of weeds into large monocultures, which would then require more drastic means of treatment, like spraying herbicides from airplanes. The Carson and Santa Fe National Forests are uniquely positioned to prevent the spread of weeds because the populations are small and isolated, when treatments in general are the most effective.

Table S-13 provides a comparison of alternatives based on the significant issues or effects, as well as how well the alternatives meet the purpose and need (objectives) for the project. The comparison table is intended to provide the public and decision makers with a clear basis for choice between alternatives.

In addition to the summarized comparison of alternatives related to significant issues and project objectives, there are a few other key differences between the effects of each alternative, based on the detailed effects analysis described in chapter 3. The most noticeable consequences from weed treatment under alternatives B, C, and D would be the long-term, beneficial improvements to native ground vegetation such as grasses, forbs and shrubs. Riparian vegetation such as rushes, sedges, willows and cottonwoods would particularly benefit from this project. Protecting and improving native plant communities would have positive effects on soil and water conditions, as well as wildlife and aquatic habitats (particularly due to enhancing riparian vegetation).

Negative effects to native vegetation, soil, water and aquatic organisms would be very minor and of short duration. The increases in sediment (more with alternative C) and herbicide delivery to streams (for alternatives B and D) would have no measurable long-term consequences. There would be a low risk of adverse impacts to fisheries, including Rio Grande cutthroat trout (a sensitive fish species) or other aquatic organisms based on application of design features, risk assessment and EPA guidelines. Alternative C would cause more ground disturbance and associated impacts to soils, especially on soils with a severe erosion hazard rating. However, all alternatives would remain with soil erosion tolerance levels needed to protect long-term soil productivity. Soils with low revegetation potential would receive herbicide treatments in alternatives B and D, while reestablishing native vegetation would take longer under alternative C. Mitigation requirements for all alternatives would ensure that vegetative ground cover is adequately reestablished. With the required design features, all soil and water quality standards would be met.

Differences between alternatives in their effects to air quality, heritage resources, livestock grazing, recreation, wilderness and visual resources are expected to be negligible, such that they would not be given weight in the decision-making process. There would be minor increases in noise and traffic associated with the action alternatives, although generally within background levels.

By controlling the spread of weeds and protecting native plant communities, habitats and watershed conditions on the two national forests, alternatives B and D would maintain or enhance social or economic conditions, particularly for local rural communities in northern New Mexico who typically rely on the forest natural resources for their livelihood, traditional culture and quality of life.

Table S-13. Comparison of alternatives by issues and objectives (purpose and need)

Significant Issues and Objectives	Alternative A	Alternative B	Alternative C	Alternative D
Issue 1: Herbicides and Human Health	No risk of health impacts from herbicide exposure (0 acres treated with herbicides).	Low risk of health impacts to workers or general public from using herbicides based on EPA registration, risk assessment data, and design features. Higher risk to people with multiple chemical sensitivities, although public notification requirement provides a means for people with this condition to avoid exposure to treated areas.	No risk of health impacts from herbicide exposure (0 acres treated with herbicides). Slightly increased risk of exposure to smoke from prescribed burning.	Same as alternative B but slightly higher risk of exposure for people with chemical sensitivities as 100 percent of treatments are with herbicides.
Issue 2: Herbicides and Wildlife	No risk of herbicide impacts to wildlife. Weeds would degrade native plant habitats, especially riparian areas important to numerous species.	Low risk of herbicide impacts to wildlife based on EPA registration, risk assessments, and design features. Native wildlife habitat quality (especially riparian habitat) would improve as weeds are eradicated and controlled.	No risk of herbicide impacts to wildlife. Less improvement in wildlife habitat.	Same as alternative B
Issue 3: Herbicides and Native Plant Communities	No short-term impacts from herbicides. In the long term, weed-caused decline in abundance and diversity of native plant communities.	Short-term reduction in some nontarget plant species. Long-term improvement in abundance and diversity of native plant communities.	Similar to alternative B for short-term reduction in nontarget plants. Low to moderate long-term improvement in native plant communities. Weed spread rate may equal or exceed control rate without herbicide use.	Same as alternative B
Issue 3 Continued: Rare or Sensitive Native Plant Species	No risk of treatment-related impacts. In the long term, weeds may cause a decline in federally listed or sensitive plant species	No impact to threatened or endangered plants due to mitigation measure. For sensitive plants, treatments “may impact individuals but are not likely to result in a trend toward Federal listing or loss of population viability,” due to design features and species locations.	Same as alternative B	Same as alternative B

Significant Issues and Objectives	Alternative A	Alternative B	Alternative C	Alternative D
Issue 4: Cost and Treatment Effectiveness (based on level of effort to meet objectives)	No cost effectiveness; would incur much higher costs in future.	Moderately cost effective.	Least cost effective.	Most cost effective.
Objectives: Protect native plant communities, soil and water quality, wildlife habitat, and long-term ecosystem health	No protection; no effectiveness. Weed-related impacts to vegetation, soil, water, riparian habitat, and other resources would continue.	Highest level of treatment effectiveness and resource protection from weed impacts due to combination of treatments including herbicides.	Lowest level of effectiveness and resource protection from weed impacts. Fewer acres treated annually for a given budget due to need for repeat treatments on the same acreage more often than when combined with other methods.	High level of effectiveness and resource protection from weed impacts. Not quite as effective as herbicides combined with other methods.

Chapter 3. Affected Environment and Environmental Consequences

Introduction

[Replaces entire section]

This chapter summarizes the physical, biological, social, and economic environments of the project area, as well as the environmental consequences of implementing the proposed action and alternatives. The environmental consequences focus on the project's purpose and need as well as issues identified in chapter 1, providing the scientific and analytical basis for the comparison of alternatives presented at the end of chapter 2. As used in this Draft SEIS "impact" means a harmful, undesirable, or negative effect.

An agency-approved adaptive weed management strategy was incorporated into this proposed project to address uncertainties about new or undiscovered weed infestations as well as post-implementation monitoring results that may indicate a need to modify treatment methods in order to meet project objectives. In the context of this uncertainty, the effects described in this chapter include consideration of the adaptive strategy, including use of treatment method selection criteria, prioritization ratings, thresholds, limitations, design features, and monitoring requirements described in chapter 2.

Cumulative Actions for Cumulative Effects Analysis

[Replaces entire section]

This section discusses other activities and land uses occurring within and surrounding the Carson and Santa Fe National Forests that could contribute to cumulative effects when added to the effects of weed treatments in this project. Cumulative effects are those impacts on the environment that result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions and can result from individually minor but collectively significant actions taking place over a period of time. Cumulative effects can be beneficial or adverse.

Unless noted in an individual resource section, the geographic extent for which cumulative effects have been evaluated consists of land administered by and immediately adjacent to the two national forests, based on the area directly or indirectly affected by project activities. The time period for cumulative effects is the time during which project activities are anticipated to occur, approximately 10 years (or more) beginning in 2015. The existing condition for each resource encompasses the past and present actions shown in table S-14. Because weed infestations are well distributed spatially, no concentration of treatment would occur across the 3 million acres comprising the two forests.

Past and Present Actions (1987 – 2014)

On June 24, 2005, the Chairman of the Council on Environmental Quality provided guidance to agencies on the consideration of past actions in cumulative effects analysis (Connaughton 2005):

> "The environmental analysis required under NEPA is forward-looking, in that it focuses on the potential impacts of the proposed action that an agency is considering. Thus, review of past actions is required to the extent that this review informs agency decision-making regarding the proposed action…Generally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

Table S-14 shows past and present actions that have affected the composition of vegetation and presence of weeds in the cumulative effects area. The table provides a short description of the action; each specialist describes the effect or trend pertinent to their resource in their section. These actions form the baseline for the cumulative effects analysis.

Reasonably Foreseeable Actions

Table S-15 on page 38 shows the reasonably foreseeable future actions that could cumulatively contribute effects from this project. It contains only human actions that are reasonably foreseeable as defined by the courts (e.g., Weinberger v. Catholic Action of Hawaii, 454 US 139, 70 E.Ed.2d 289 (1981)). The table provides a short description of the action; each specialist describes the effect or trend pertinent to their resource in their section.

Table S-16 on page 39 summarizes the cumulative effect to the key issues identified in chapter 1. The left column in the table states the key resource followed by the specific effect this project could cause that resource. The middle columns display other past, present or foreseeable future actions that are expected to cumulatively contribute to or counteract the specific effect listed in the left column. The last column, on the right, predicts the overall cumulative effect to the resource listed.

Table S-14. Past and present actions (1987-2013) contributing towards the cumulative effects baseline

Action	Description	Comment
Annual treatment of noxious weeds in the Carson and Santa Fe National Forests	Removes noxious weeds by pulling, grazing, mowing, treating with chemicals, or other methods.	For example: herbicide treatment of saltcedar on the Jemez Ranger District from 1999 – 2002; goat grazing of yellow toadflax south of Tres Piedras; annual, ongoing manual control by both national forests (hand pulling)
Road construction and maintenance	Uses heavy equipment to build or maintain permanent or temporary roads.	
Trail construction and maintenance	Uses hand tools or light equipment (e.g., ATV) to build or maintain trails.	
Creation of unauthorized routes	Created by repeated driving in the same place off system roads or trails.	
Construction and reconstruction of recreational facilities (such as campgrounds, fishing access, toilet installations)	Generally uses heavy equipment.	For a full list of developed recreational facilities built since 1987, see the project record.
Subdivision and development of private inholdings and land adjacent to the two national forests		
Mining claims and development of mining		
Wildfires, including suppression and rehabilitation	This category includes suppression activities such as use of fire retardants and building fire line with hand tools or heavy equipment. It also includes rehabilitation work such as seeding and mulching to reduce erosion.	For a complete list of wildfires since 1987 in the Carson and Santa Fe National Forests, see the project record.
Hazardous fuels treatment and prescribed burning	Thinning trees by hand or with equipment. Conducting prescribed fires.	For a complete list of hazardous fuels projects since 1987 in the Carson and Santa Fe National Forests, see the project record.
Livestock grazing	Annual grazing of cattle pursuant to permit terms.	
Jemez National Recreation Act	This act established the Jemez National Recreation Area (JNRA) to conserve, protect, and restore the recreational, ecological, cultural, religious, and wildlife resource values of the Jemez Mountains. The JNRA is comprised of 100,000 acres within the Jemez Mountains. The Santa Fe National Forest has developed numerous recreational facilities, campgrounds, day use sites, and fishing access, within the JNRA.	

Action	Description	Comment
Wild and Scenic Rivers – Pecos, East Fork Jemez, and Rio Chama (SFNF) and Rio Grande (CNF)	Designated these rivers for their "outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations" (PL 90-542, 1968).	
Creation of the Valles Caldera National Preserve	The creation of the Valles Caldera National Preserve made lands previously in private ownership open to public use. The Valles Caldera National Preserve is made up of 89,000 acres within the Jemez Mountain Range and offers numerous recreational opportunities.	
Land transfers from the Carson and Santa Fe National Forest to other entities, for example: San Ildefonso and Santo Domingo.		
Respect the Rio program	The Respect the Rio program is a multi-faceted restoration and education program started in 2001 and designed to balance the need for preservation of riparian and flood-prone areas with needs of the public. The Respect the Rio Program seeks to do this by accomplishing the following goals: 1. Identifying and addressing water quality issues that have developed from recreational use. 2. Educating the public about habitat, habitat needs and ongoing restoration projects. 3. Creating community partnerships. 4. Creating a program and materials that are easily adaptable to other forests and agencies.	
Acquisition of lands, for instance Echo Amphitheatre (Carson NF)	The Forest Service acquires lands through purchase, exchange, or transfer.	A comprehensive list of acquisitions is not available at this time.
Road decommissioning	Removes roads from the landscape, usually using heavy equipment to restore the natural slope and reseed. Has also occurred naturally with vegetation growing in unused roads.	A comprehensive list of past road decommissioning is not available at this time.
Forest product collection	This includes products covered by a permit, such as fuelwood and Christmas trees, and other products such as piñon and products used for religious ceremonies.	

Action	Description	Comment
Administrative use	This includes uses authorized by the Forest Service with a special use permit (excluding forest product collection) and the use of Forest Service roads by Forest Service staff to manage the national forest. Examples of activities authorized by a special use permit are access to communication sites, access to utility corridors, and outfitter and guide.	
Weed treatments on land in other jurisdictions	Removes weeds by pulling, grazing, mowing, treating with chemicals, or other methods.	For example: mowing and herbicide application in rights-of-way by the NM Department of Transportation; herbicide treatments by private landowners within or adjacent to the national forests, with or without the participation of local soil and water conservation districts (extent unknown); New Mexico Salt Cedar Control Project along the Pecos and Rio Grande Rivers (2002-2003) by the NM Association of Conservation Districts; treatment of Russian olive and saltcedar by various soil and water conservation districts (2003) under the Non-Native Phreatophyte Eradication Project along the Rio Grande; big sage control treatments on the Jicarilla Reservation; treatment of Siberian elm along the Santa Fe River by the Santa Fe Watershed Association and the City of Santa Fe; weed treatments on BLM-managed lands
Oil and gas leasing		The Jicarilla Ranger District (CNF) has over 800 gas wells with associated roads, pipelines, and other facilities. In November 2012, the Santa Fe National Forest signed a decision to amend the forest plan to allow oil and gas leasing with certain stipulations.
Preparation of travel management plans and motor vehicle use maps by other national forests and agencies	Designates a system of roads and trails where people are allowed to drive. Generally reduces the amount of driving off-road allowed.	All national forests and grasslands in New Mexico, and some Bureau of Land Management Districts.
Special Use Permits – acequia improvements, rights-of-way for pipelines (water/natural gas), driveways, communication sites, outfitter/guides, etc.	Replacement and/or repair of acequia headgates and related infrastructure (rights-of-way for driveways, pipelines, electric lines, etc.) to private lands, authorization for outfitters/guides for recreational activities within and adjacent to National Forest System lands.	

Table S-15. Reasonably foreseeable future actions (2015-2025)

Action	Description	Comment
Preparation of travel management plans and motor vehicle use maps by other national forests and agencies	Designates a system of roads and trails where people are allowed to drive. Generally reduces the amount of driving off-road allowed.	All national forests and grasslands in New Mexico, and some Bureau of Land Management Districts.
Transfer of management of lands in Pecos Canyon from New Mexico Department of Game and Fish to the State Parks	SJM 16 authorized New Mexico State Parks to enter into a Joint Powers Agreement with the New Mexico Department of Game and Fish to better manage recreation on 186 acres of land divided among six locations along the Pecos River. These locations provide fishing access, day use, and overnight camping opportunities along the Pecos River.	
Projects on the SOPA		The project record contains the list of projects on the most recent “Schedule of Proposed Actions” as of the date of this writing.
Geothermal leases in Coyote and Cuba Ranger districts	The Santa Fe National Forest is expecting a geothermal leasing proposal in the near future. The proposal would be to drill exploration wells north and west of the Valles Caldera National Preserve. Small roads would be developed to access the exploration wells. If the project moves to completion, production wells and a powerline would be installed.	The project record shows a map of the area expected for leasing. The grey striped area is where the proposed leasing would be requested.
Oil and gas leases in Cuba Ranger District	The proposal is to lease additional acreage adjacent to lands currently leased for oil and gas. Short roads would be developed to any new wells installed and would remain in use until the well is abandoned at which point the road would be reclaimed.	The project record contains a map showing existing oil and gas leases (grey striped areas) and those proposed for expansion or improvement (red boxes, on legend as "Pending Expressions”).
Oil and gas development on the Jicarilla Ranger District	The Reasonable Foreseeable Development Scenario projects the addition of up to 700 new wells within the planning period. The actual number of wells depends on many factors, including the economy and changes in technology.	
Acquisition of Miranda Canyon (CNF)	The Forest Service acquires lands through purchase, exchange, or transfer. This parcel is approximately 5,000 acres.	

Action	Description	Comment
Weed treatments on land in other jurisdictions	Removes weeds by pulling, grazing, mowing, treating with chemicals, or other methods.	For example: mowing and herbicide application in rights-of-way by the NM Department of Transportation; herbicide treatments by private landowners within or adjacent to the national forests, with or without the participation of local soil and water conservation districts (extent unknown); New Mexico Salt Cedar Control Project along the Pecos and Rio Grande Rivers (2002 – 2003) by the NM Association of Conservation Districts; treatment of Russian olive and saltcedar by various soil and water conservation districts (2003) under the Non-Native Phreatophyte Eradication Project along the Rio Grande; big sage control treatments on the Jicarilla Reservation; treatment of Siberian elm along the Santa Fe River by the Santa Fe Watershed Association and the City of Santa Fe; weed treatments on BLM-managed lands.

Table S-16. Summary of cumulative actions by key resource

Key Resource and Effect to that Resource	Other Actions Contributing to the Effect to the Resource	Other Actions Countering the Effect to the Resource	Predicted Cumulative Effect
Human Health & Safety: risk of health impacts from herbicide exposure	Other actions that introduce chemicals into the environment include, but are not limited to: herbicides recently applied or expected to be applied in northern New Mexico by San Juan and Sandoval County Weed Management Areas, Soil and Water Conservation Districts, Bureau of Indian Affairs, Valles Caldera National Preserve, Bureau of Land Management, National Park Service, Santa Fe Watershed Association, The Nature Conservancy, and Audubon Society. Other actions that may introduce chemicals are: vehicle use; maintaining, constructing, and reconstructing facilities and roads; extracting oil, gas, geothermal, and mineral resources; and the aerial application of fire retardant.	Creation of motor vehicle use maps (fewer places that people can drive); restoration projects (less chance of needing fire retardant) such as El Rito Canyon Landscape Restoration Project, Southwest Jemez Mountains Landscape Restoration Project, Upper Bitter Creek Project, and the Tio Gordito Project	The risk of exposure to the public or workers is considered to be negligible (unforeseen accidents excepted). Because the risk of exposure is immeasurable (below EPA standards), the cumulative effect cannot be measured.

Key Resource and Effect to that Resource	Other Actions Contributing to the Effect to the Resource	Other Actions Countering the Effect to the Resource	Predicted Cumulative Effect
Native Vegetation: loss of native plants	Other actions that could cumulatively cause a loss of native plants are: cutting trees and prescribed burning (for a season or less); grazing livestock; camping outside developed sites; constructing new facilities (e.g., Resumadero Campground; Buckman water diversion facilities, power lines, and road reconstruction); and clearing vegetation from highway rights-of-way.	Other actions that would cumulatively promote native plants are: cutting trees and prescribed burning (e.g., in the same project as listed above), weed control activities on public and private lands, seeding, planting, and erosion control following wildfires, fuel reduction activities (by allowing more sunlight to reach the forest floor and promoting native grasses and shrubs), and meadow and riparian restoration projects.	Because the loss of native plants caused by the implementation of this project is expected to last a season or less, it would not cause negative effects when considered cumulatively with other actions.
Wildlife & Fish: herbicide-related health risk	Same actions as described for “Human Health & Safety.”	Same actions as described for “Human Health & Safety.”	The risk of exposure to wildlife and fish is considered to be negligible (unforeseen accidents excepted). Because the risk of exposure is immeasurable (below EPA standards), the cumulative effect cannot be measured.
Wildlife & Fish: reduction in native vegetation and thus habitat	Other actions that could cumulatively, but temporarily, reduce native vegetation cover that may provide nesting, foraging or hiding cover habitat for some species include: thinning and removing trees, prescribed burning, livestock grazing, restoration projects along riparian areas, and weed control treatments on private or other public lands. These actions, however, tend to reduce native habitats for a season or less during and just after project activities. After a season, native vegetation is restored or increases.	Wildfire burn area rehabilitation (seeding, planting, etc.), fuel reduction activities (such as the projects listed under Human Health and Safety), meadow and riparian restoration projects, and fish habitat improvement projects on public and private lands also contribute to restoration of high quality wildlife and fish habitat. Weed control activities on public and private lands add to the beneficial cumulative effects of the project by restoring diverse vegetation/habitat that is being displaced by weeds.	The overall effect of this project would be to promote native vegetation; cumulatively, it would contribute to improved habitat for fish and wildlife when considered in context with other landscape restoration projects.

Key Resource and Effect to that Resource	Other Actions Contributing to the Effect to the Resource	Other Actions Countering the Effect to the Resource	Predicted Cumulative Effect
Wildlife & Fish: disturbance	Other actions that could disturb wildlife and fish by causing noise or having people and machinery present are: maintaining, constructing, and reconstructing roads and facilities; oil and gas operations; forest thinning; prescribed burning; wildfire suppression; wildlife and fish habitat improvements (e.g., eliminating exotic fish, building fish barriers for Rio Grande cutthroat trout); reintroductions of wildlife species; or animal control actions conducted by the New Mexico Department of Game & Fish; driving vehicles; and camping, picnicking, and other recreational activities.	Actions that cumulatively reduce disturbance are: road and area closures, road decommissioning projects, and travel management.	Disturbance from this project is expected to be negligible because the acreage of each habitat treated would be small. Because the direct and indirect effect would be immeasurable, there would be no cumulative effect.
Soil & Water: risk of unacceptable levels of soil erosion, sedimentation, and/or chemical contamination	Actions that could cumulatively increase these impacts for a season or less are: thinning, prescribed burning, livestock grazing, maintaining, constructing, and reconstructing roads and facilities, driving on and off roads and trails, camping, equestrian uses, gathering forest products, and weed control activities on private or other public land.	Actions that are expected to cumulatively stabilize soils, increase soil productivity, and improve water quality are: weed control activities on private and other public lands (by reducing erosion caused by some weeds and restoring native plants that have better soil holding characteristics); wildfire burn area rehabilitation (erosion/sediment control); fuel reduction activities; meadow and riparian restoration; dispersed recreation site restoration; and road and trail closures.	The direct and indirect effects to soil and water are expected to be negligible because of the mitigations measures in place for each of the proposed treatments (e.g., seeding bare soil, not using certain herbicides near water, and others). Because the direct and indirect effect would be immeasurable, there would be no cumulative effect.
Air Quality: smoke or dust particulates	Other prescribed burning, wildfires, and residential firewood and trash burning add to regional haze. Driving on dirt roads within and adjacent to the forests temporarily causes dust.	Projects, such as thinning, that reduce the risk of wildfire.	Dust from this project would be negligible; therefore, there would be no cumulative effects. Smoke from prescribed burning is regulated by the State of New Mexico; thus, no cumulative effects can occur because no burning is allowed under conditions that smoke would exceed state levels.

Assumptions Common to the Analysis of Effects

[New section]

The interdisciplinary team used these assumptions when analyzing effects to the various resources. Assumptions specific to each resource are listed in each respective section.

For alternative A (no action):

- Weeds would spread, on average, at a rate of 8 percent per year (DiTomaso 2000, Tu et al. 2001, Frid et al. 2013). The rate of spread will not be uniform – it is species- and site-dependent. For instance, different species thrive at different elevations.

For the action alternatives (B, C, and D):

- Alternatives B and D would result in the control or eradication of current weed populations in approximately a decade. Some populations would be easily eradicated, and others would only be contained.
- New weed populations will establish themselves. People, wind, and animals all spread weed seed “hitchhikers”.
- Alternative C would result in ongoing control without foreseeable eradication of current weed populations on the forests. The cost of mechanical treatment is very high, and the other methods are not as effective or efficient as the use of herbicides.
- All pertinent design features and monitoring requirements would be implemented.
- The action alternatives will not result in a noticeable increase in the amount of traffic and noise over normal Forest Service business. The reason for this is that no new personnel would be hired to treat weeds. Even if contracted, contract crews would constitute a very small portion of the driving and work taking place in the project area on a given day.
- The Forest Service may drive off roads to treat weeds. This use is expected to be negligible, because most of the known weed infestations occur along roads and trails. Any driving off roads by agency personnel or contractors to treat weeds would be very limited in time and space; it would not occur every day in the same place, nor is it projected to be a repeated event.
- Each national forest expects to treat an average of 300 to 800 acres per year (600 to 1,600 per year for both forests on average) depending on funding and methods used.
- Each national forest expects to treat no more than 1,500 acres per year (3,000 per year for both national forests as a maximum).

Vegetation

[Replaces entire section]

Affected Environment

The first part of this section discusses the weeds known to occur as well as other potentially affected vegetation. The second part focuses on sensitive plant species.

The Carson and Santa Fe National Forests lie within the Colorado Plateau Semi-Desert Province and Arizona-New Mexico-Mountains Semi-Desert-Open Woodland-Coniferous Forest-Alpine Meadow Province (Mountains Regime) of the Tropical/Subtropical Steppe Division; and the Great Plains-Palouse Dry Steppe Province and the Southern Rocky Mountains Steppe-Open Woodland-Coniferous Forest-Alpine Meadow Province (Mountains Regime) of the Temperate Steppe Division within the Dry Domain. Fire, insects, and disease are the primary natural sources of disturbance to vegetation (McNab and Avers 1994).

Vegetation types follow altitudinal gradients similar to those in the southern Rocky Mountains. Dominant vegetative cover types occurring in the two national forests include grasslands, sagebrush, shrublands, piñon-juniper, oak, ponderosa pine, mixed conifer, spruce-fir and subalpine. Within each of these cover types, riparian vegetation is found along streams, around lakes, and in valley bottoms.

Weeds threaten the biological diversity of native plant communities, ecosystem processes, and rare or special status plants. Weeds are highly adaptable and adept at usurping available moisture and nutrients, quickly spreading, and supplanting native vegetation. Weed infestations invariably lead to (1) a decline in abundance of native plants that occupy the same or similar habitats as the weeds, (2) undesirable changes in site conditions such as soil pH that may be vital to native plant survival, and (3) an overall loss in the richness and diversity of native plants. The weed species known to occur on the two national forests are listed in chapter 1 and described in detail in appendix 2.

The FEIS listed the known weed populations in both forests as being approximately 7,260 acres. Today (9 years later) we are aware of about 15,260 acres of weeds. Though studies show that expansion rates vary between 5 and 30 percent annually (Tu et al. 2001), the increase in weeds in the project area is mostly explained by more surveys of the locations of weeds by Forest personnel in the 9 years since the FEIS was published.

Infestations of Russian knapweed, hoary cress and yellow toadflax have been identified in highway rights-of-way within the national forest boundaries. Major wildfires have occurred on both forests in recent years. Monitoring of recent high severity burns has identified these areas as locations for new infestations.

The Jemez Ranger District of the Santa Fe National Forest completed the Jemez Riparian Enhancement Project in 2000, which shows that saltcedar, Russian olive, and Siberian elm trees can be effectively controlled using selective herbicides. Previously approved, small acreage weed control treatments have also occurred on the Carson National Forest, and on both forests where other agencies have jurisdiction such as along highway rights-of-way.

Table S-17 displays the total acres of known weed infestations by vegetation cover type. The following paragraphs briefly describe the location of each vegetation cover type and list the inventoried weed infestations found in each. Figure S-3 displays the dominant vegetation types on the Carson and Santa Fe National Forests.

Grasslands (Blue grama, perennial grass mix, upper forb mix)

Grasslands are widespread at all elevations within both forests, typically as openings within shrublands and forest cover types. Weed species include black henbane, bull thistle, Canada thistle, leafy spurge, musk thistle, scotch thistle, yellow starthistle and yellow toadflax.

Table S-17. Weed infestations by vegetation type

Vegetation Type[1]	Total acres[2]	Total acres of vegetation type infested with weeds[3]	Percent of vegetation type infested with weeds	Percent of all weeds in this vegetation type	Percent of project area
Aspen	79,044	214	0.27	1.6	0.01
Big sagebrush	177,218	391	0.22	2.9	0.01
Blue grama	16,826	19	0.12	0.1	0.001
Deciduous shrub mix	113,185	734	0.65	5.5	0.02
Juniper	229,178	961	0.42	7.3	0.03
Perennial grass mix	205,676	1,137	0.55	8.6	0.03
Piñon-juniper	411,180	1,552	0.38	11.7	0.05
Ponderosa pine mix	936,088	5,101	0.54	38.5	0.16
Sparsely vegetated	16,086	47	0.29	0.4	0.001
Spruce-fir	318,255	355	0.11	2.7	0.01
Upper deciduous-evergreen forest mix	731,753	2,733	0.37	20.6	0.08
Upper forb mix	20,086	7	0.04	0.1	0.0002
Total	**3,254,576**	**13,253**		**100.0**	**0.41**

1. Vegetation types are from the mid-scale vegetation analysis.
2. Includes privately held lands within National Forest System boundary.
3. Total acreage is off by 3 due to rounding error (total acres of weeds is 13,256).

Sagebrush-Shrub (Big sagebrush, deciduous shrub)

Sagebrush and shrub are widespread at lower and middle elevations (6,200-7,900 feet) within both forests, typically as openings within forest cover types. Weed species known to be present include black henbane, bull thistle, Canada thistle, Dalmatian toadflax, musk thistle, perennial pepperweed, Russian knapweed, Scotch thistle, and spotted knapweed.

Piñon-Juniper (Piñon-juniper, juniper)

Piñon-juniper cover types are widespread at lower and middle elevations (5,700-8,400 feet) within both forests. Weed species known to be present include bull thistle, Canada thistle, Dalmatian toadflax, diffuse knapweed, leafy spurge, musk thistle, Russian knapweed, Scotch thistle, Siberian elm and spotted knapweed.

Ponderosa Pine Mix

Ponderosa pine cover types are widespread at middle elevations (7,200-9,000 feet) within both forests. Weed species known to be present include bull thistle, Canada thistle, Dalmatian toadflax, diffuse knapweed, leafy spurge, musk thistle, Russian knapweed, Russian olive, Scotch thistle and yellow toadflax.

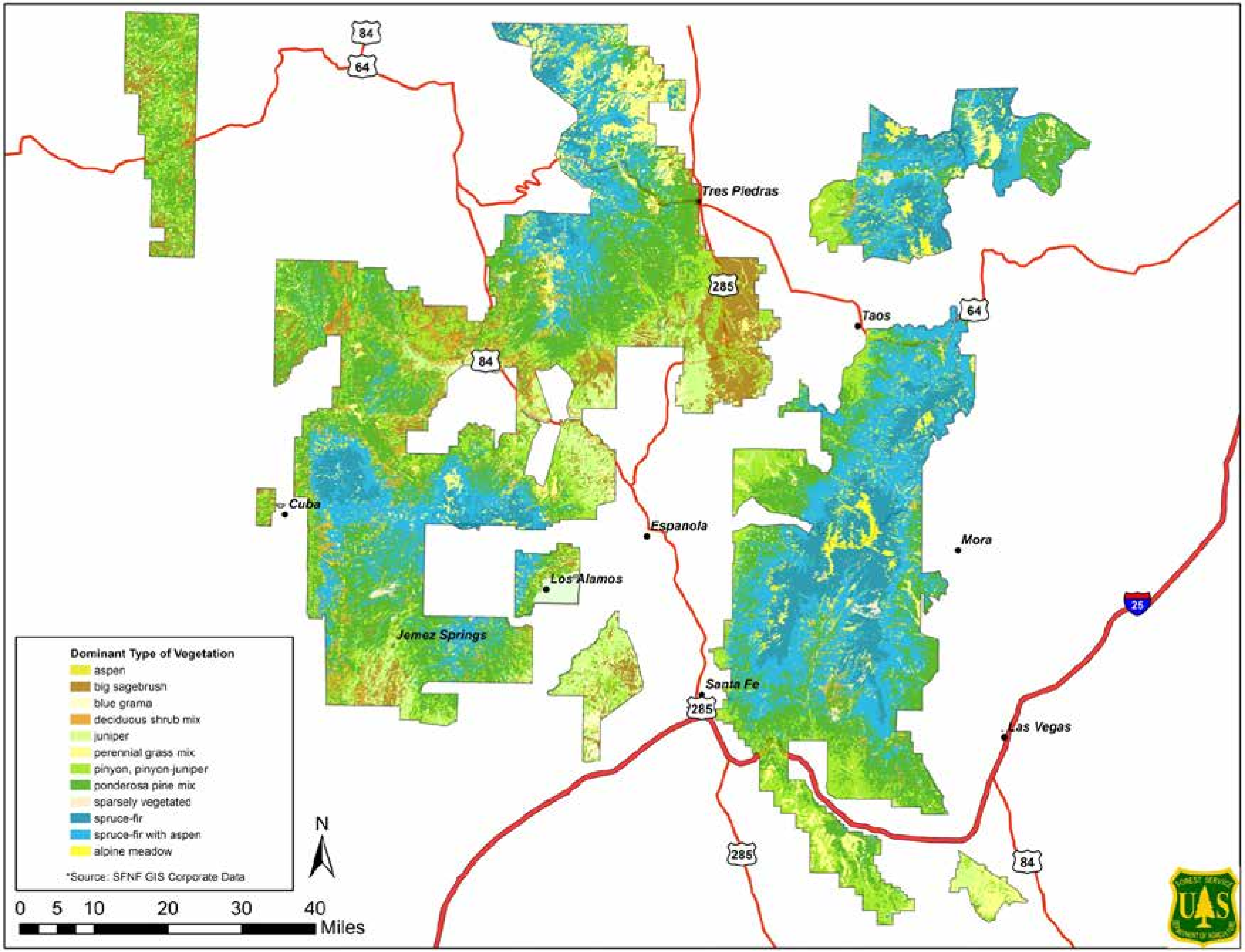

Figure S-3. Dominant vegetation types on the Carson and Santa Fe National Forests

Upper Deciduous-evergreen Forest Mix and Aspen

Mixed conifer and aspen cover types are widespread at middle and upper elevations (6,900-11,200 feet) within both forests. Weed species known to be present include black henbane, bull thistle, Canada thistle, diffuse knapweed, leafy spurge, musk thistle, Russian knapweed, Scotch thistle, spotted knapweed and yellow toadflax.

Spruce-fir

Spruce-fir cover types are widespread at upper elevations (8,700-11,500 feet) within both forests. Weed species known to be present include bull thistle, Canada thistle, musk thistle, Russian knapweed and yellow toadflax.

Riparian Areas and Valley Bottom Lands

Riparian areas and valley bottoms with wet soils are widespread throughout all elevations within both forests. Riparian areas often overlap other cover types at the mapping scale used for this analysis. Where information indicated riparian areas present, these acres were subtracted from other cover types so they were not counted twice. Weed species known to be present include bull thistle, Canada thistle, Dalmatian toadflax, cheatgrass, hoary cress, musk thistle, poison hemlock, Russian knapweed, Russian olive, saltcedar, Scotch thistle, Siberian elm, spotted knapweed and yellow toadflax, and Fuller’s teasel.

Environmental Consequences to Vegetation

Alternative A (No Action)

[Replaces first paragraph]

The no-action alternative would not meet the purpose and need. It would not help maintain or improve diverse, sustainable native plant communities in weed-infested areas. It would result in continued invasion and spread of weeds throughout the two national forests and particularly on and near acres currently infested. Without an overall system to treat weeds, the Forest Service would be required to complete NEPA analysis on individual projects to treat weeds using methods other than hand-grubbing, which alone has not proven effective. Given the conservative estimate of an 8 percent spread per year, the number of acres impacted by weeds would double over the next 10 years. When the uninventoried areas or unidentified weed populations are factored in, there may be 10 to 20 percent more weed infested acres than are currently inventoried.

[Additional paragraph]

The establishment of weed monocultures would probably occur in some areas, which could alter historical trends and natural ecosystem functions and processes in native plant communities (DiTomaso 2000). For example, following the 1996 Dome Fire on the Santa Fe National Forest, cheatgrass became an established monoculture in Bland Canyon. This resulted in an earlier fire regime than what exists under native vegetation. Similarly, the amount of culturally important plants (such as osha) could be reduced as they are replaced by invasive species.

[Replaces last sentence of 4th paragraph, p. 71]

Knapweed infestations would have long-term detrimental effects on soil and water resources (USDA Forest Service 2007).

Alternative B - Proposed Action

[Replaces first paragraph]

Table S-18 through table S-29 display the treatments proposed in the project area's different vegetation types. The vegetation types are from the two national forests' midscale vegetation analysis. Acreages of weeds do not match precisely for two reasons. First, rounding errors from the GIS analysis are present. Second, weed species would be treated by multiple methods, so the acres listed in these tables are double counted. For example, spotted knapweed could be treated using herbicides, grazing, and by manually pulling. Thus, these tables display the *maximum* number of acres that could be treated by the method listed. The project record contains the suite of methods proposed in each vegetation type.[6]

[The following tables replace tables 15 through 23]

Table S-18. Acres of treatment method in in aspen

Treatment	Alternative B	Alternative C	Alternative D
Biological	15	15	0
Grazing	190	190	0
Herbicides	214	0	214
Manual	86	86	0
Mechanical	213	213	0
Prescribed Fire	1	1	0
Total known acres of weeds in this vegetation type	**214**		

Table S-19. Acres of treatment method in big sagebrush

Treatment	Alternative B	Alternative C	Alternative D
Biological	141	141	0
Grazing	146	145	0
Herbicides	391	0	391
Manual	231	231	0
Mechanical	391	391	0
Prescribed Fire	55	55	0
Total known acres of weeds in this vegetation type	**391**		

[6] VEG03_MidscaleVegDomTypeAlternativesAcres_20131021.xlsx

Table S-20. Acres of treatment method in blue grama

Treatment	Alternative B	Alternative C	Alternative D
Biological	16	16	0
Grazing	0	0	0
Herbicides	19	0	19
Manual	3	3	0
Mechanical	19	19	0
Prescribed Fire	0	0	0
Total known acres of weeds in this vegetation type	**19**		

Table S-21. Acres of treatment method in deciduous shrub mix

Treatment	Alternative B	Alternative C	Alternative D
Biological	193	193	0
Grazing	363	363	0
Herbicides	734	0	734
Manual	424	424	0
Mechanical	693	693	0
Prescribed Fire	57	57	0
Total known acres of weeds in this vegetation type	**734**		

Table S-22. Acres of treatment method in juniper

Treatment	Alternative B	Alternative C	Alternative D
Biological	577	577	0
Grazing	227	227	0
Herbicides	961	0	961
Manual	749	749	0
Mechanical	938	938	0
Prescribed Fire	104	104	0
Total known acres of weeds in this vegetation type	**961**		

Table S-23. Acres of treatment method in perennial grass mix

Treatment	Alternative B	Alternative C	Alternative D
Biological	716	716	0
Grazing	378	373	0
Herbicides	1,137	0	1,137
Manual	951	951	0
Mechanical	1,094	1,094	0
Prescribed Fire	7	7	0
Total known acres of weeds in this vegetation type	**1,137**		

Table S-24. Acres of treatment method in piñon-juniper

Treatment	Alternative B	Alternative C	Alternative D
Biological	782	782	0
Grazing	357	357	0
Herbicides	1,552	0	1,552
Manual	1,040	1,040	0
Mechanical	1,467	1,467	0
Prescribed Fire	221	221	0
Total known acres of weeds in this vegetation type	**1,552**		

Table S-25. Acres of treatment method in ponderosa pine

Treatment	Alternative B	Alternative C	Alternative D
Biological	1,672	1,672	0
Grazing	2,099	2,094	0
Herbicides	5,101	0	5,101
Manual	3,626	3,626	0
Mechanical	4,870	4,870	0
Prescribed Fire	295	295	0
Total known acres of weeds in this vegetation type	**5,101**		

Table S-26. Acres of treatment method in sparsely vegetated areas

Treatment	Alternative B	Alternative C	Alternative D
Biological	38	38	0
Grazing	0.01	0.0001	0
Herbicides	47	0	47
Manual	38	38	0
Mechanical	47	47	0
Prescribed Fire	0.3	0	0
Total known acres of weeds in this vegetation type	**47**		

Table S-27. Acres of treatment method in spruce-fir

Treatment	Alternative B	Alternative C	Alternative D
Biological	37	37	0
Grazing	317	317	0
Herbicides	355	0	355
Manual	136	136	0
Mechanical	355	355	0
Prescribed Fire	0	0	0
Total known acres of weeds in this vegetation type	**355**		

Table S-28. Acres of treatment method in upper deciduous-evergreen forest

Treatment	Alternative B	Alternative C	Alternative D
Biological	545	545	0
Grazing	1,762	1,759	0
Herbicides	2,733	0	2,733
Manual	1,695	1,695	0
Mechanical	2,619	2,619	0
Prescribed Fire	149	149	0
Total known acres of weeds in this vegetation type	**2,733**		

Table S-29. Acres of treatment method in upper forb mix

Treatment	Alternative B	Alternative C	Alternative D
Biological	7	7	0
Grazing	0.004	0.004	0
Herbicides	7	0	7
Manual	7	7	0
Mechanical	7	7	0
Prescribed Fire	0	0	0
Total known acres of weeds in this vegetation type	**7**		

[Replaces third paragraph, page 76]

Biological methods avoid loss of nontarget plants altogether, as the insects cannot be released without APHIS approval, based on assurance that they would only consume the target weed species. The effectiveness of using biological methods to control weeds and restore native species would be more gradual and would not be detectable in the short term. Manual methods would be able to usually avoid cutting or digging up nontarget plants. Herbicides applied manually or with backpack sprayers would use directional spray devices that minimize herbicide drift on nontarget vegetation. Adherence to wind and weather condition requirements would minimize the amount of spray that would drift through the air onto nontarget plants. Vehicle-mounted herbicide spraying is less precise but includes a directionally controlled wand and on/off switch to minimize hits to nontarget vegetation. Mechanical, grazing and burning methods would impact entire roadsides or areas treated, unless a torch is used to burn just weed species. However, those three methods are expected to be used sparingly (appendix 7) so they would have very little effect on native vegetation across the two national forests. In addition, because methods like burning, grazing and mowing only remove the tops of plants, they would have a less intense short-term effect on the ground cover. On a landscape level, the temporary reduction in native species would be negligible.

[Additional paragraph]

Properly managed, controlled livestock grazing can work in combination with other methods to reestablish healthy, resilient native plant communities. For example, cattle grazing, used appropriately through timing, duration, and intensity can effectively control cheatgrass. Altering the timing, intensity, and duration of livestock grazing in riparian areas that have been treated for saltcedar can favor reestablishment of the native riparian flora while slowing down the recovery of saltcedar.

[Additional paragraph]

Alternative B is expected to be the most effective at controlling weeds; studies show that herbicides alone are not as effective as when they are combined with other methods (DiTomaso 2000, Endress et al. 2012, Frid et al. 2013). Frid et al. (2013) found early detection and treatment, before a seedbed is established, a key component of controlling weeds. The same study found that seeding with native vegetation (cultural methods) in combination with other treatments greatly reduced the chance that weeds would reestablish.

Alternative C – No Herbicides

[Replaces entire section]

The most noticeable effects to native vegetation would be the beneficial increase in native species abundance and diversity on the treated acres, similar to effects described for alternative B. The main difference with this alternative is that for a given budget, fewer acres would be treated each year. More follow-up on the same sites would be needed to control weeds. Biological controls would likely be effective in the long term, after biocontrol insect populations have grown enough to have a significant effect on weed populations, which could take years. The other nonherbicide treatment methods are generally not as effective against weed species as herbicide treatment in combination with these other methods. For a fixed amount of funding, the acres treated would logically be fewer in alternative C than alternative B.

Regardless of the nonherbicidal methods used, follow-up weed treatments at relatively close intervals could potentially impact native vegetation because the treatment areas would be in a disturbed condition more often and for longer periods. Even though follow-up treatments would control weeds, each time an area is retreated, soils and native vegetation would be disturbed, which can create favorable growing conditions for all plants, native and invasive. Under this alternative, it is likely that the rate of weed spread would exceed the rate of weed control, and the Forest Service would not be able to get ahead of the weed problem. Thus, effects in the long term would be most similar to alternative A (no action).

Alternative D – Herbicides Only

[Replaces entire section]

Beneficial effects to native vegetation abundance and diversity on the treated acres would be very similar to effects described for alternative B. The key difference is the slightly reduced effectiveness of some herbicide treatments without the supplemental use of other methods. It is well known from past studies that the most effective weed control treatments are those that utilize a combination of herbicides and nonherbicide methods. This reduced effectiveness means that repeated treatments may be required above what would be necessary if a combination of treatments were used.

Numerous species of weeds would not be controlled with herbicides alone. For example, saltcedar has been successfully treated with herbicides and mechanical treatments that, in combination, have proven more effective at controlling or eradicating it than herbicides alone.

Continuous use of herbicides alone can lead to other problems. DiTomaso et al. (2006) report that the repeated use of herbicides can have a detrimental effect to the legume species that are important components of rangelands, pastures, and wildlands. Herbicidal control that lowers the abundance of these forbs may cause losses in the ecological function of rangelands and may ultimately accelerate further degradation (Endress et al. 2012). Repeated use can increase the abundance of other undesirable species, particularly annual grasses like medusahead. Finally, one population of yellow starthistle in Washington developed a resistance to picloram, and was cross-resistant to clopyralid, which acts in the same manner. Thus, the potential exists for weeds to develop resistance to herbicides if used year after year (DiTomaso et al. 2006).

Unlike alternative C, this reduced effectiveness would not likely result in a reduction in the number of acres treated because the cost-effectiveness of treating with herbicides is high.

Cumulative Effects – Vegetation

[Replaces entire section]

In all action alternatives, cumulative impacts to nontarget plant species would stem from forest management activities, public land uses, and activities on other public and private lands, as described in the beginning of this chapter.

Cumulative Impacts to Native Vegetation

The direct and indirect effects to native vegetation from controlling or eradicating weeds would be an increase in the amount, vigor, and diversity of native plants. The cumulative effect from projects affecting native vegetation is expected to be an overall increase in the amount, vigor, and diversity of native plants across the project area. The focus of forest management in the reasonably foreseeable future would primarily be restoring fire-adapted ecosystems, native vegetation, and ecosystem functionality.

Photo 4. Leafy spurge
(Santa Fe National Forest photo)

Implementing this project would add to the short-term reduction in nontarget vegetation from herbicides applied in other ongoing weed treatment projects on private inholdings and on other public lands in and around the two national forests. Long-term ecosystem restoration projects would compensate for activities that remove or damage native vegetation, including short-term removal of nontarget plants from this proposed project.

Cumulative Impacts to Weeds

The predicted direct and indirect effect of this project is the reduction in the acreages and species of weeds present on the two national forests. The overall cumulative impact, when added to other, ongoing activities in the spatial area is difficult to assess. Some projects and activities would promote weeds, while others have a tendency to reduce them. On balance, it appears the overall trend is towards the establishment of new weed populations.

For example, weeds could establish themselves in areas where activities disturb soil, such as thinning, firewood gathering, prescribed burning, dispersed recreation, grazing, road maintenance, road building, and decommissioning even with preventive measures in place. Ongoing, common activities in the Carson and Santa Fe National Forests by weekend recreationists, forest firefighting crews, grazing allotment permittees, or livestock all have the potential to unknowingly spread weeds from one location to another, bring them onto National Forest System lands, or spread them onto other lands.

Wildfires that burn with moderate to high severity through populations of invasive weeds often result in an exponential growth of that population, both in homogeneity and spatial extent. Many weed species (such as cheatgrass) are fire-adapted and can quickly invade an area and spread beyond any ability to control them. During the suppression of large wildfires, firefighting personnel and equipment can be brought in from different locations within the United States. If the vehicles come from or pass through places with weed populations, they can introduce new weed species. Firefighting equipment (vehicles) are generally well maintained, including cleanliness, and would probably not have as great a potential for unintentionally transporting weeds into the forest as would forest visitors, contractors, and others that come by motor vehicle. Motor vehicles are capable of not only bringing invasive weeds onto the national forests but can just as easily transport weeds to other land ownerships.

Cyclic changes in weather (drought, wet warm springs, and late winter weather) and subtle changes in climate can increase the establishment and spread of nonnative species. Many nonnative grasses and forbs are cool season plants that can take advantage of relatively warm wet springs at lower elevations or drought conditions that leave many native species unable to out-compete the nonnatives for limited moisture and nutrients. Lower elevation ecosystems such as piñon-juniper woodlands naturally have high amounts of bare soil, warmer weather, less available moisture during the growing season, and are more susceptible to disturbance and invasive plant establishment when compared to higher elevations where moisture is not limiting and herbaceous plant communities are more resilient and more able to compete with weeds.

The activities that would cumulatively reduce the amount of weeds in the two national forests are weed control projects on other lands and prevention and educational efforts. Such projects would reduce the possibility of weed transport into the forests. Conversely, treating weeds on the two national forests would reduce the potential to transport weeds onto other lands. The preventive measures associated with public land projects, such as cleaning vehicles before they arrive at a site, would tend to reduce the introduction of new populations.

Special Status Plants

[Replaces entire section]

Special status plants are those listed as threatened or endangered under the Endangered Species Act or designated sensitive by the Southwestern Region regional forester of the Forest Service. The vegetation specialist report in the project file has detailed habitat information for each species.

Affected Environment for Endangered Plants

The only federally listed plant species in the project area is the endangered Holy Ghost ipomopsis (*Ipomopsis sancti-spiritu*) and its critical habitat (table S-30). No threatened plants exist on either forest.

The only known population of the Holy Ghost ipomopsis exists in continuous scattered patches along 2 miles of Holy Ghost Canyon on the Santa Fe National Forests. The acreage of occupied habitat covers about 15 acres and the individual plants number approximately 2,500 (USDI 2002). In addition to the main population, Holy Ghost ipomopsis seedlings have been planted in Winsor, Panchuela, and Indian canyons as part of a recovery effort. There are no known weeds currently growing within the Holy Ghost ipomopsis populations. Holy Ghost Canyon is the only designated critical habitat for this plant.

Table S-30. Threatened or endangered plant species

Plant Species	Habitat	Estimated Acres of Habitat[1]	Acres of Known Weeds in the Habitat[2]	Proportion of Sensitive Species Habitat Affected
Holy Ghost Ipomopsis and Critical Habitat	South aspect slopes in Holy Ghost Canyon, Santa Fe National Forest. Plants have been transplanted to other places to aid recovery.	15	0	0

[1] Acres of habitat is based on known areas of occupancy.

[2] Acres of weed infestations are populations known as of August 1, 2013. Comprehensive surveys of both national forests have not been completed.

Affected Environment for Sensitive Plants

Table S-31 identifies the sensitive plants growing or likely to occur in the two national forests. Acres of habitat are based on a combination of habitat type and known areas of occupancy. Acres of weeds in the habitat are based on known populations as of August 1, 2013. Where two numbers exist in a single cell, the top number is the Santa Fe National Forest and the bottom number is the Carson National Forest.

Table S-31. Forest Service Southwestern Region regional forester's sensitive plant species, 2013, on the Santa Fe (SF) and Carson (C) National Forests

Sensitive Plant Species	Forest	Habitat	Estimated Acres of Habitat	Acres of Known Weeds in the Habitat	Proportion of Sensitive Species Habitat Affected
Alpine larkspur *Delphinium alpestre*	C	Alpine meadows. Potential habitat 11,500-13,000 ft. Three known locales all Taos County; Latir Peak, Gold Hill and Wheeler Peak.	48,513	9	0.02
Arizona willow *Salix arizonica*	SF C	Subalpine, high elevation meadows. Pecos Wilderness and Midnight Meadows.	14,119 18,162	13 761	0.09 4.2
Chaco milkvetch *Astragalus micromerius*	SF	Rio Arriba County in two known locales.	104,018	312	0.3
Chama blazing star *Mentzelia conspicua*	SF	Upper Chama River valley. Specialized habitat on gray to red shale and clay of the Mancos and Chinle formations on slopes of road cuts.	3,021	132	4.4
Greene (Wheel) milkweed *Asclepius uncialis uncialis*	SF	Rare and small populations in stable grasslands but widespread through plains States. Specimen from Mesita de los Ladrones, Anton Chico Grant. Small stature easily overlooked. Found in juniper-savannah.	27,160	169	0.6
Heil's alpine whitlow grass *Draba heilii*	SF	Specimen found in the Pecos Wilderness in open areas above timberline. Extreme rarity. Named in 2009.	13,191	0.005	0.00004
Pagosa milkvetch *Astragalus missouriensis var. humistratus*	C	Limited to clay soils of Mancos and Lewis formations. One location on Jicarilla RD* on black Mancos shale. One herbarium record in NM Biodiversity.org	124,636	1,013	0.8
Pecos fleabane *Erigeron subglaber*	SF C	Subalpine meadows of high elevation coniferous forests. All in Pecos and Wheeler Peak Wilderness except one population on Elk Mountain.	5,491 256,990	0 75	0 0.03
Pecos (Gunnison's) mariposa lily *Calochortus gunnisonii var. perpulcher*	SF	Type specimen found in the Pecos Wilderness 8,500 -11,200 ft. aspen glades, John's Canyon, Beulah mountain meadows, Harvey's Ranch near Las Vegas, NM. Appearance is a pale yellow form of the flower.	50,615	78	0.2
Ripley's milkvetch *Astragalus ripleyi*	C	Mainly Tres Piedras RD and south of Questa. Obvious, pale lemon flowers, many acres in several localities. Sagebrush/shrubs and piñon/juniper/oak woodland/open Ponderosa pine	175,908	704	0.4

Sensitive Plant Species	Forest	Habitat	Estimated Acres of Habitat	Acres of Known Weeds in the Habitat	Proportion of Sensitive Species Habitat Affected
Robust larkspur *Delphinium robustum*	C	Canyon bottoms and aspen groves from 7,000-10,000 ft. No populations known on Santa Fe National Forest. One specimen from Carson National Forest in Taos County on Camino Real RD. Others from Eagle Nest and Angel Fire.	95,793	17	0.02
Small-headed goldenweed *Lorandersonia (Ericameria) microcephala (=Happlopappus m.)*	C	Ponderosa pine zone Narrow range near Tres Piedras, Petaca to Las Tablas west of FR519. Grows on granitic dome hills rock outcrops, rock cracks.	51	0	0
Springer's blazing star *Mentzelia springeri*	SF Los Alamos County only	No specimens found on Forest. Occurs on pumice deposits.	13,947	169	1.2
Tufted (Galisteo) sand verbena *Abronia bigelovii*	SF	Occurs on gypsum deposits. One location on Forest in Section 35 south of Navajo Peak.	8,805	437	5.0
Wood lily *Lilium philadelphicum (umbellatum)*	SF	Scattered locations throughout forest in cool, moist site openings. North slopes in ponderosa and mixed conifer. Vulnerable from damage to wetland areas and collecting. State endangered.	52,158	220	0.4
Yellow lady's-slipper *Cypripedium parviflorum pubescens*	SF	Pecos Wilderness and adjacent areas. Rare. Small scattered populations very vulnerable to collecting. No specimens known for the Carson National Forest.	58,671	1,771	3.0

* RD= ranger district

Environmental Consequences to Special Status Plants

With the design features in place, determinations for the action alternatives are:

- Not likely to adversely affect the Holy Ghost ipomopsis.
- No impacts are expected to the sensitive plants that occur in alpine and subalpine forest communities (alpine larkspur, Arizona willow, Heil's alpine whitlow grass, Pecos fleabane, Pecos mariposa lily, and yellow lady's-slipper).
- Based on design features for sensitive plants, no impacts are expected to lower-elevation sensitive plant species. These species are very uncommon or are found only in very limited environments or some are not found on National Forest System lands but occur within a county. An individual of a species may be impacted, but is not likely to result in a trend toward Federal listing or reduced viability of the population for the other species of sensitive plants (Chaco milkvetch, Chama blazing star, Greene milkweed, Pagosa milkvetch, Ripley's milkvetch, robust larkspur, small-headed goldenweed, Springer's blazing star, tufted (Galisteo) sand verbena, and wood lily).

Cumulative Effects to Sensitive Plants

The direct and indirect effects of this project would be short-term disturbance (less than 1 day) on none or less than 5 percent of any plant’s habitat. Over time, the removal of weeds would promote or preserve the native vegetation. The direct and indirect effect to sensitive plants would be immeasurable, and would not contribute any noticeable cumulative effect when added to other activities in the analysis area.

Effects of Forest Plan Amendment to Vegetation, including Special Status Plants

The effects of the proposed plan amendment to vegetation in future projects would be the same as described in this “Vegetation” section. The amendment changes where and when weeds could be treated (in areas of high human habitation, in municipal watersheds, and on certain soils); once cleared for treatment, the effects of treatments themselves would be the same as described in this section. Obtaining clearance or permission for treatment could take longer due to the consultation and analyses required.

Wildlife Resource

[Replaces entire section]

Methodology

Each species’ habitat was modelled using GIS by the particular vegetation type it typically uses.

The “Environmental Impact Statement for the Santa Fe National Forest Plan” (1987) used habitat as a proxy for the management indicator species chosen for the Forest. The management indicator species were chosen based on commonly used habitats, their economic importance, or their high social interest.

Management indicator species are defined in the 1986 Carson National Forest Plan as, “[t]hose species selected in the planning process to monitor the effects of planned management activities on viable populations of all wildlife and fish species, including those species that are socially or economically important.” The Carson National Forest Plan designates specific management indicator species that could best be used to analyze the effects of site-specific proposals on the national forest. The Carson National Forest Plan allows flexibility on how management indicator species habitat and population trends are monitored. The 1986 EIS for the Carson Forest Plan described the habitat groups and characteristics along with projected trends of management indicator species, based on current direction and management of these habitats. The basis for determining habitat trend is a comparison of estimated management indicator species habitats at the time of preparing the forest plan to the present. The methods used to determine current habitats were developed to approximate similarity (to the degree possible) to the acreages used in the 1986 forest plan EIS. In some cases, the estimated acres of management indicator species habitats are based on certain parameters of habitat quality. The rationale and methods used to reach the current habitat estimates are described for each species or group. The methods generally included developing queries from existing vegetation stand exam data.

Environmental Consequences Common to All Species

This section describes effects common to all wildlife species. The analysis focuses on the key issues identified in chapter 1, which are (1) how the weed treatments may cause habitat disturbance (noise and visual disturbance); (2) negative health impacts from herbicides used; or (3) impacts to habitat quality from reductions in existing surface vegetation.

Alternative A – No Action

As described in the "Vegetation" section of this draft SEIS, without treatments, over time weeds would continue to reduce the abundance and diversity of native vegetation that provides habitat for native wildlife species. For species that rely on native habitat, a decline in habitat quality would occur. For species that do not rely on the displaced habitat, no effect would occur.

The no-action alternative would allow weed populations to continue to expand beyond the 13,256 acres of presently known weeds. Monocultures of weeds cause structural changes in habitat, altering habitat. The habitat elements that native plants provide for wildlife, such as nesting and ground cover, grass production, seed sources, and prey base, would be reduced. The reduction in the amount of these habitat elements would negatively affect populations of big game, predator, small mammal, bird, reptile, and amphibian species. Because the weed populations are presently small in proportion to the entire acreages of both forests, immediate loss of habitat or forage is not expected. Untreated, however, weeds expand at an estimated rate between 5 and 30 percent annually (see "Vegetation" section), depending on the species and ecologic conditions at each infestation site.

Over time, weeds could displace native habitat on large acreages and cause detrimental impacts to wildlife on the two national forests. For example, in Colorado the invasion of Russian knapweed has resulted in a large reduction in the availability of winter range for wildlife. In Montana it was estimated that there would be a loss of 220 elk annually due to weed invasions of big game winter ranges (FICMNE 1998). In Arizona, stands of the weed Lehmann lovegrass have fewer quail, small mammals, and seed-harvesting ants (FICMNE 1998). Frid et al. (2013) show that weed populations are more difficult to eradicate once a seedbed has been established.

Alternative B – Proposed Action

Alternative B offers the most flexibility for controlling weed populations, and thereby is predicted to result in the most improvement of native plant communities when compared to alternatives C or D. Because of the diversity of treatment methods available, weeds are the most likely to be successfully controlled under alternative B, thus restoring the most native vegetation and promoting biological diversity.

Given the same level of funding, Forest personnel expect to be able to treat the most acreage with the most success under alternative B. For instance, for a number of weed species that resprout from roots left after mechanical or manual treatments (e.g., Canada thistle or spotted knapweed), integrated treatments would be highly effective at reducing populations. As existing weed populations are controlled or eradicated, fewer treatments would be required after several years.

The treatment methods themselves pose a low risk to individual animals and no detectable effect to populations. A very small percentage (less than 1/100th of a percent) of habitat for any species would be treated in a given year. Because weeds exist in scattered patches across the two national forests, treatments would also be widely distributed. Weeds often establish themselves in disturbed areas, like road sides and recreation sites, which animals tend to avoid because of human presence. Thus, treatments are not expected to pose any additional disturbances to most wildlife.

The next paragraphs describe effects for the key issues:

Disturbance to Habitat: Disturbance to habitat from treatments is not expected to adversely impact wildlife species or populations. Mechanical methods (mowing, tilling), prescribed burning, and vehicle-mounted herbicide applications would cause the most noise. Biological controls would cause little to no noise disturbance. Manual methods, controlled grazing, and manual application of herbicides would cause minimal noise and habitat disturbance. Typically, the duration of traffic would be limited to 1 or 2 days and once complete, wildlife would soon return to these areas. The level of effect also depends on the current level of background noise for an area. Since many areas with weed infestations are near roads, trails, and high use recreation sites, wildlife that use these areas probably would be habituated to the presence of people.

Fluctuating noise levels may elevate heart rate, catecholamine levels, and corticosteroid levels in wild animals, but these elevated levels are generally of short duration, and animals often habituate to these disturbances over time. Short-term increases in these measures do not correlate well with actual stress experienced by animals. Finally, since most wildlife would avoid the treatment areas during activities, the risk of direct herbicide exposure to those animals would be minimal.

Modification of Habitat: Overall, treatments may result in modified habitat for a season or less; the long-term effect of promoting native vegetation (and thus habitat) would be beneficial. Weed treatments would cause temporary, localized reduction in existing vegetation, including some native vegetation that could be killed or removed along with the weeds. This would not measurably impact wildlife habitat due to the relatively small acreages that would be treated in a given time and habitat, along with the design feature that requires prompt evaluation and revegetation of treated sites where bare soil is exposed. Ground cover would be expected to return by the first growing season after treatment, and the abundance and diversity of native vegetation would gradually return over subsequent growing seasons.

Each method would have a slightly different, but minimal effect, on the structure and composition of wildlife habitat. None of the treatments would result in a loss of large trees, snags, or down log habitat components that are important for many species.

Controlled grazing with sheep or goats would change the structure of vegetation, but the magnitude of this change would be small. The risk of transmitting disease to bighorn sheep would be avoided by not allowing sheep or goats to graze in bighorn sheep areas. The Carson and Santa Fe National Forests have a permanent closure order prohibiting pack goats in wilderness areas.

Biological controls (introduction of insects) would not adversely affect habitat for wildlife since this method would have been studied to ensure that the insects are plant-host specific. Thus the insects would not impact native vegetation or other beneficial insects.

Manual methods of weed control such as hand pulling, cutting or digging would result in minimal changes in wildlife habitat quality, especially when conducted on such a small scale and spread widely across the forests. Mowing or mechanical weed treatments would not result in any major alteration in habitat quality.

Burning of individual weeds with a propane torch would leave the remaining habitat structure and composition intact. Broadcast burning weed infestations in grasslands or similar habitats conducive to burning would result in a minor and temporary change to the seral stage and vegetative community. A controlled surface burn would result in little, if any, loss of large snags or down logs, so it would not impact the habitat trend or populations of snag-dependent species such as hairy woodpecker.

The impacts from herbicide use on vegetation structure depend on the specific application method, type of herbicide, rate of application, and season of application. Effects would be a change in composition of forbs, grasses, and shrubs in treatment areas. Nontarget plants could be damaged by unintentional application, drift, or residual soil activity of herbicides. These short-term impacts to plant composition and community diversity would likely be offset within as little as the first growing season. There would be no long-term loss of species diversity of native vegetation due to the proposed treatments, and species composition under most treatments is expected to resemble native plant assemblages within 1 to 3 years. For additional discussion relative to vegetation, see the "Vegetation" section.

Herbicide Toxicity Effects: Risk assessments of the herbicide formulations proposed for use have considered the risk of harm that could be caused by their use (USDA Forest Service 1992, SERA 2002-2007). The risk assessments concluded that potential risks of harm to most wildlife species are low for herbicide formulations proposed for use at the rates and application methods proposed.

Thus herbicides, when used at the application rates and concentrations listed on the labels, would have a very low risk of causing harm (short or long term) to wildlife species. There is a general lack of data and some uncertainty relative to herbicide effects on amphibians, so there is the potential for an unquantifiable impact on amphibians from herbicide application. Based on design features and the risk assessments, the risk of toxicity to amphibians is considered low. Design features that minimize herbicide delivery in or near waterbodies, limit the amount of herbicide used within a given watershed, and limit the type of application permitted in riparian areas are required. Also, the extent of proposed herbicide treatments within potential amphibian habitat areas is very small. If herbicides were to impact individual amphibians on a local basis, it would not affect the population as a whole. Population or habitat trends would not be impacted for any of the wildlife species that occur on the forests.

Alternative C – No Herbicides

Like alternative B, eradicating, controlling, or containing weeds under alternative C would improve native vegetation and help maintain or improve biological diversity on the areas treated. However, given the same level of funding as alternative B, fewer acres would be treated and the effectiveness of each treatment application would be less than alternative B. For a number of weed species that resprout from roots left after mechanical or manual treatments (e.g., Canada thistle or spotted knapweed), even a greater number of return treatments would probably not be highly effective at reducing populations. Treating weeds in a given area would require concentrated effort over several years. In the places where weed treatments are not successful, or if the spread rate of weeds continues to exceed the rate of control, the long-term effects would be similar to alternative A. Thus, the beneficial improvements to native vegetation and wildlife habitat would be lower for this alternative.

Short-term disturbance effects and habitat alteration effects to wildlife would be similar to those described for alternative B, except there would be more repeat treatments to achieve the objective so recovery of native vegetation would probably take longer. This alternative would completely eliminate the risk to individual animals posed by herbicide toxicity.

Alternative D – Only Herbicides

As with alternatives B and C, implementation of this alternative would improve native vegetation and help maintain biological diversity by eradicating, controlling, or containing weeds on the two national forests. Some species of weeds do not respond to treatments that apply herbicides alone; for these sites, repeated treatments could be necessary and the expected effectiveness in meeting objectives would fall between alternatives B and C.

Effects of this alternative would be very similar to those described for alternative B. One difference would be that it eliminates the risk to individuals posed by mechanical treatments. The level of noise and habitat disturbance would be slightly less than either alternative B or C as the use of herbicides would result in a reduced need for repeat treatments on many sites.

Cumulative Effects Common to All Species

In all action alternatives, cumulative impacts to nontarget plant species would stem from forest management activities, public land uses, and activities on other public and private lands, as described in the beginning of this chapter.

The weed infestations occupy less than one-half of 1 percent of the forests' acreage and are well dispersed. Treatments will be spread out in both time and space. The actual direct and indirect effects of each alternative on wildlife are predicted to be of such low magnitude that they cannot be measured. In all action alternatives, treatment in specific species habitat is limited to less than 5 percent of the habitat for any one species. Of the species analyzed, only three have more than 5 percent of their habitat affected by weeds, with the largest being about 17 percent for Gunnison's prairie dog. The addition of this disturbance to the amount of disturbance caused by other activities is not likely to overlap in space and time, and will not be measurable. With the design features in place, concentrations of herbicides and the duration of exposure on the terrestrial environment would be small and well below levels at which chronic exposure effects are documented.

Although some individual animals may be affected (through short-term disturbance effects), no impacts to population or habitat trends is predicted, even when considering this project's impacts in addition to other impacts occurring in the project area.

Affected Environment for Management Indicator Species

Management indicator species were identified during development of the forest plans and are used to monitor effects of management activities on populations of wildlife and fish, including those that are socially or economically important.

Table S-32 displays the two national forests' management indicator species, the estimated acres of existing habitat, the habitat trend, the population trend, and the acres and percent of weed infestations within those habitats. The estimated acres and percent represent the maximum amount of habitat that would be treated given the weed populations we know about as of this writing.

Table S-32. Wildlife management indicator species, habitat and weed infestation

Species[1]	National Forest	Habitat[1]	Habitat Trend[1]	Population Trend[1]	Estimated Acres (Miles) of Habitat	Estimated Acres (Miles) of Habitat with Weeds[2, 4]	Percent of Habitat with Weeds
Brewer's sparrow	Carson	Sagebrush	Stable to increasing	Stable	96,083	377	0.4
Juniper titmouse	Carson	Piñon-Juniper	Declining	Stable	352,263	1,445	0.4
Piñon jay	Santa Fe	Piñon-Juniper	Declining	Stable	362,176	1,381	0.4
Abert's squirrel	Carson	Ponderosa Pine	Increasing	Increasing	486,497	1,414	0.3
Merriam's turkey	Carson	Most habitat types	Increasing	Stable to Increasing	574,875	1,431	0.3
	Santa Fe		Stable to Increasing	Stable	417,789	4,111	1
Hairy woodpecker	Carson	Snags and down logs in all habitats	Increasing	Stable	719,950	1,508	0.2
	Santa Fe		Increasing	Stable	804,768	6,125	0.8
Rocky Mountain elk	Carson	All habitats	Stable	Stable	1,485,417	5,112	0.3
	Santa Fe		Stable	Increasing	1,216,074	8,931	0.7
Mourning dove	Santa Fe	Most habitats	Stable to Increasing	Stable	908,160	6,866	0.8
Rocky Mountain bighorn sheep	Carson	Alpine	Stable	Stable	9,474	4	0.04
	Santa Fe		Stable	Stable	7,817	0.005	0.0001
White-tailed ptarmigan	Carson	Alpine	Stable	Stable	48,513	9	0.02
Red squirrel	Carson	Mixed Conifer	Increasing	Stable	486,497	1,414	0.3
Mexican spotted owl	Santa Fe	Mixed Conifer	Declining	Stable	198,889	660	0.3
Rio Grande cutthroat trout	Carson	Aquatic	Stable	Stable	(138)	(1.8)	1.3
	Santa Fe		Stable	Declining	3,924	5	0.1
Resident trout[3]	Carson	Aquatic	Stable	Stable	(770)	(19)	2.3
Aquatic macro-invertebrates	Carson	Aquatic	Stable	Stable	(1,850)	(44)	2.4

1. From Carson and Santa Fe National Forests forestwide management indicator species reports (USDA Forest Service 2011, 2012).
2. Acres of weeds are based on populations known as of August 1, 2013.
3. Resident trout include Rainbow, German brown, Brook, and Rio Grande cutthroat trout. The latter is addressed individually.
4. Acres of weeds located along linear miles of stream were calculated using a 66-foot buffer on each side of the aquatic habitat.

The discussion of each species below is taken from the forest plans and management indicator species reports (USDA Forest Service 1986a, 1987a, 2011, 2012).

Brewer’s Sparrow

Brewer’s sparrow is an indicator for sagebrush habitat. In northern New Mexico the habitat for Brewer’s sparrow is sagebrush, brushy plains and the interface of piñon-juniper, woodlands, and sagebrush. Brewer’s sparrow is strongly associated with high sagebrush vigor throughout its range, preferring areas dominated by high shrub cover, large patch size and bare ground. The trend for habitat on the forest is stable to increasing based on the gradual conversion of grasslands to sagebrush. The population trend for the Carson National Forest is considered stable.

Juniper (Plain) Titmouse

The juniper (plain) titmouse is an indicator species for the presence of piñon-juniper canopies. Also known as “juniper” titmouse, the titmouse is a resident of deciduous or mixed woodlands, favoring oak and piñon-juniper. The titmouse usually nests in natural cavities or old woodpecker holes primarily in oak trees, but it is capable of excavating its own cavity in rotted wood. The species feeds mainly on insects, seeds and occasional fruits, and also is a bark gleaner. As a cavity nester, large, older trees are an important feature. The Carson National Forest shows a decrease in acres of habitat from between 1986 and 2011. There is a downward trend in habitat, with a loss of about 4.0 percent since 1986. The population trend, however, is stable. This titmouse is a common species on the forest.

Piñon Jay

Piñon jays nest mainly in stands of piñon and juniper trees. They need open woodlands for nesting and an adequate supply of seeds, especially nuts. They are gregarious and breed in colonies up to 150. They spend the winters in large flocks of tens to thousands searching for piñon nuts, which are a primary food source. The forest plan modeling predicted that piñon jay habitat would improve with the implementation of projects that would improve foraging habitat. In 2002, drought and subsequent invasion by the Ips beetle caused many piñon trees in the Forest to die, resulting in a loss of about 18 percent of piñon jay habitat. Thus, the habitat trend for piñon jay is ranked as declining. The population trend for the Santa Fe National Forest is ranked as stable based on the management indicator species report and breeding bird survey routes located near the forest.

Abert’s Squirrel

Abert’s squirrel is an indicator for the presence of interlocking canopies in ponderosa pine. Abert’s squirrel depends on ponderosa pine for its life necessities and requires diversity of age classes and tree densities. Pine twigs, pine cones, pine seeds, pine bark, as well as truffles are used by Abert’s squirrel. In addition to pure ponderosa pine stands, Abert’s squirrels are also associated with Gambel oak, true piñon, juniper, quaking aspen and Douglas-fir. Habitat on the Carson National Forest has increased just over 20 percent from 1986. The habitat condition for the species is considered poor to fair, but in an upward trend. The Abert’s squirrel population on the Carson National Forest is on an upward trend at this time.

Merriam’s Turkey

Merriam’s turkey has the widest distribution and is the most common subspecies of turkey. It is found in many mountainous areas of northern New Mexico. The bird uses ponderosa pine, a source of mast (nuts and seed) and its favorite roosting tree. The ponderosa pine is an essential component of its permanent habitat, while surface water is a range requirement. Turkeys prefer to roost in tall mature or overmature ponderosa pines with relatively open crowns and large horizontal branches starting at 20 to 30 feet from the ground. Trees with a diameter of over 14 inches are used as roosts. A healthy ponderosa pine understory provides the turkey cover as well as forage. The Santa Fe National Forest

Plan modeling determined that feeding habitat was the primary limiting factor for turkey, and that timber harvest patterns promoting early-seral stages were the most beneficial for turkey. The turkey was used as an indicator for the presence of old-growth pine in the Carson National Forest Plan. The Santa Fe National Forest rates the habitat trend for turkey as stable to increasing; and the Carson National Forest rates the trend as slightly upward. The Santa Fe National Forest management indicator species report rates the turkey population as stable. The Carson National Forest management indicator species report indicates a stable to upward trend for turkeys on that forest due to transplants into previously unoccupied habitat.

Hairy Woodpecker

The hairy woodpecker is a forest generalist, keying in on available snags and live aspen. On both forests this species is found in areas with abundant snags and downed logs. Nests are primarily in trees averaging 17 inches in diameter and approximately 60 feet high. It forages primarily on tree trunks averaging 17 inches in diameter and greater than 30 feet high. Down logs are important for foraging by providing insects. The habitat trend on the Santa Fe National Forest is upward. The habitat trend on the Carson National Forest is considered upward. Population trends on both forests are considered stable.

Rocky Mountain Elk

Rocky Mountain elk inhabit most forest types with good forage and cover. These ungulates use a variety of habitat types during the course of their life. They appear to be extremely adaptable to a variety of successional stages and vegetation types. The habitat trends on the Santa Fe and Carson National Forests are rated as stable. The population trend for elk is rated as increasing on the Santa Fe National Forest and stable on the Carson National Forest.

Mourning Dove

Mourning dove habitat is abundant in the Santa Fe National Forest. They are found in ponderosa pine, spruce-fir, aspen, and piñon-juniper forest types. Most nesting occurs in lower elevation habitats. The abundance of nesting and cover opportunities on the Santa Fe National Forest contribute to maintaining viable populations of mourning dove. The habitat trend for mourning dove is considered stable to increasing across the forest. The population trend for mourning dove on the Santa Fe National Forest is ranked as stable based on the statewide trend and breeding bird surveys in and next to the forest.

Rocky Mountain Bighorn Sheep

Rocky Mountain bighorn sheep inhabit cliffs, crags, and other extremely rocky areas in tundra and alpine areas from the summit peaks to around 200 meters below treeline of the mountains of northern New Mexico. Bighorn prefer precipitous terrain adjacent to suitable feeding sites of high mountain meadows with grasses, forbs and browse species. Currently, bighorn sheep occur in the Pecos, Latir Peak, and Wheeler Peak Wilderness areas and the Gold Hill area. For both national forests, the habitat and population trends are considered stable.

White-tailed Ptarmigan

The white-tailed ptarmigan is used as an indicator for the presence of alpine tundra and subalpine deciduous shrub. Little is known about this avian species in New Mexico, for it lives on the windswept tundra above 11,000 feet. The presence of high elevation shrubby willows (*Salix* spp.) is likely the most important factor for successful over wintering of the species. On the Carson National

Forest, ptarmigan habitat approximately coincides with the habitat for bighorn sheep, as ptarmigan were reintroduced into the Pecos Wilderness in 1981. Ptarmigans are also considered to be present on Costilla, Latir, Wheeler, Truchas and associated peaks. For the Carson National Forest, white-tailed ptarmigan habitat and population trend are considered stable.

Red Squirrel

Red squirrels are an indicator species for the mixed-conifer habitat type. The squirrels require mature coniferous trees as a source of cones and seed. The best cone production occurs in 200- to 300-year-old Douglas-fir, 40- to 300-year-old white fir, and 150- to 200-year-old Engelmann spruce. The red squirrel is predominantly found in areas with greater than 60 percent canopy closure. Red squirrel habitat on the Carson National Forest has increased approximately 20 percent from 1986. The habitat trend is considered upward. The population trend is considered stable.

Mexican Spotted Owl

The Mexican spotted owl is an indicator species of old growth, coniferous forest. Nesting and roosting habitat is characterized by steep topography, cool shady canyons, and mature mixed conifer forest having high canopy closure. Protected activity centers are established by the Forest Service to protect territories of individual Mexican spotted owl. The Carson National Forest has very few areas that are suitable for Mexican spotted owls; only one protected activity center exists on the Jicarilla Ranger District. The Mexican spotted owl population on the Santa Fe is considered rare but the trend is rated as stable. Since the writing of the Santa Fe National Forest Management Indicator Species Report was written, the Las Conchas Fire of June 2011 burned through nine Mexican spotted owl protected activity centers and habitat.

Rio Grande Cutthroat Trout

The Rio Grande cutthroat trout is one of 14 subspecies of cutthroat trout native to the western United States. Rio Grande cutthroat trout are an indicator of clear, cold mountain lakes and streams within the Rio Grande Basin in Colorado and New Mexico. The decline in Rio Grande cutthroat trout numbers in New Mexico is attributed to many factors, which include but are not limited to: (1) introduction of nonnative trout species who either prey upon or hybridize with Rio Grande cutthroat trout; (2) dewatering of streams for irrigation; and (3) altered stream habitat. On the Carson National Forest, Rio Grande cutthroat trout habitat and population trends are stable. On the Santa Fe National Forest, the habitat trend is stable and the population trend is downward.

Resident Trout

Resident trout species are used as indicator species for quality perennial streams and riparian vegetation. Resident populations reproduce and sustain themselves in the wild. Defined also as “resident trout” in the Carson National Forest Plan are the rainbow trout (*Oncorhynchus mykiss*), German brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), and Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*). Except for the Rio Grande cutthroat trout, all resident trout in the Carson National Forest are nonnatives that have been stocked extensively in northern New Mexico over the past 100 years. Resident trout habitat and population trends are stable on the Carson National Forest.

Aquatic Macroinvertebrates

Aquatic macroinvertebrates, or aquatic insects, are found in lakes, streams, ponds, marshes and puddles and help maintain the health of the water ecosystem by eating bacteria and dead, decaying plants and animals. Local populations of certain aquatic macroinvertebrates are indicator species of high quality water. They are an indicator of overall aquatic conditions, quality of fisheries, and associated riparian habitat. For the purpose of analyzing the effects of forest management activities, the primary habitat requirement for aquatic macroinvertebrates is perennial water which supports resident trout. For the Carson National Forest, aquatic macroinvertebrate habitat and population trends are currently stable.

Environmental Consequences to Management Indicator Species

Effects previously described for all wildlife habitat and populations on the forests apply to management indicator species. The following table provides additional information about the estimated effects of each alternative for each specific management indicator species on each forest.

Table S-33. Effects to management indicator species

Management Indicator Species	Alternative A No Action	All Weed Management Alternatives: B, C, and D
Brewer’s sparrow	No impacts to population or habitat trends are expected because sagebrush habitat is not threatened by weeds.	Same as alternative A.
Juniper titmouse	No impacts to population or habitat trends because weeds are not expected to threaten the piñon pine canopy on which the juniper titmouse depends.	No impacts to population or habitat trends are expected because weed treatments would not affect piñon pine canopy used by juniper titmouse. Any changes in understory structure as a result of weed treatments would not affect population or habitat trends because this isn’t a component the species depends on.
Piñon jay	No impacts to population or habitat trends because weeds are not expected to threaten the piñon pine habitat on which the jay depends.	No impacts to population or habitat trends are expected because weed treatments would not affect piñon pine trees used by piñon jay. Any changes in understory structure as a result of weed treatments would not affect population or habitat trends because this isn’t a component the species depends on.
Abert’s squirrel	No impacts to population or habitat trends because weeds are not expected to affect interlocking canopies in ponderosa pine used by Abert’s squirrel.	No impacts to population or habitat trends are expected because weed treatments would not affect interlocking canopies in ponderosa pine used by Abert’s squirrel. Any changes in understory structure as a result of weed treatments would not affect population or habitat trends because this isn’t a component the species depends on.

Management Indicator Species	Alternative A No Action	All Weed Management Alternatives: B, C, and D
Merriam's turkey	No impacts to population or habitat trends because weeds are not expected to affect the old growth pine (roost tree, roost tree groups) used by the turkey. Weeds would continue to displace native plants, grasses and insects used by turkeys, so habitat quality would decline.	No impacts to population or habitat trends are expected because weed treatments would not affect old growth pine (roost tree, roost tree groups) used by turkeys. No impacts to population or habitat trend are expected because weed treatments would result in improving native grasses and other surface vegetation so would improve turkey habitat. Some loss of vegetation for a season following treatments could cause temporary displacement.
Hairy woodpecker	No impacts to population or habitat trends because weeds do not affect snags and down logs important to hairy woodpecker.	No impacts to population or habitat trends because weed treatments would not cause a loss of large snags or down log habitat components on which the woodpecker depends. Any changes in understory structure as a result of weed treatments would not affect population or habitat trends because this isn't a component the species depends on.
Rocky Mountain Elk	Weeds would continue to displace grasses used as elk forage so habitat would decline in quality and quantity.	No impacts to population or habitat trend are expected because weed treatments would result in improving elk foraging habitat. Some loss of vegetation for a season following treatments could occur, but elk are wide ranging and would not be affected by this minute change.
Mourning Dove	Weeds would continue to displace native habitat in a wide variety of habitats that this species depends upon, resulting in a decline in habitat.	No impacts to population or habitat trend are expected because weed treatments would restore native vegetation that this species uses. Since the dove uses a wide variety of habitats, temporary changes to understory structure in small patches of its habitat as a result of treatments would not impact population or habitat trends.
Rocky Mountain Bighorn Sheep	No impacts to population or habitat trend are expected because weeds are expected to remain very limited in high elevation grassland bighorn sheep habitat.	No impacts to population or habitat trend are expected because weeds aren't expected to thrive at these high elevation grasslands, so very little of its habitat would be treated on an annual basis. This means at any time, over 99 percent of the sheep's habitat would be intact.
White-tailed ptarmigan	No impacts to population or habitat trend are expected because weeds are expected to remain very limited in higher elevation alpine tundra and subalpine deciduous shrub habitat.	No impacts to population or habitat trend are expected because weeds aren't expected to thrive at these higher elevation alpine and subalpine habitats, so very little of the ptarmigan habitat would be treated on an annual basis. This means at any time, over 99 percent of the ptarmigan's habitat would be intact.

Management Indicator Species	Alternative A No Action	All Weed Management Alternatives: B, C, and D
Red Squirrel	No impacts to population or habitat trend are expected because weeds do not affect mature mixed conifer trees used as primary red squirrel habitat.	No impacts to population or habitat trend are expected because weed treatments would not affect mature mixed conifer trees used as primary red squirrel habitat. Any changes in understory structure as a result of weed treatments would not affect population or habitat trends because this isn't a component the species depends on.
Mexican spotted owl	Weeds would continue to displace native plants, grasses and insects used by prey species of the owl, so habitat quality would decline.	No impacts to population or habitat trend are expected because weed treatments would compose a small percentage of protected activity centers and Mexican spotted owl habitat. Treatments would prevent further spread of weeds into prey habitat, which would be beneficial to the prey species that the owl feeds upon - therefore beneficial to the owl.
Rio Grande cutthroat trout	Weeds would continue to displace native plants and grasses within riparian, so habitat quality and perennial water quality would decline.	With design features in place the proposed action may have an indirect impact to individuals of the Rio Grande Cutthroat Trout (RGCT). RGCT is carnivorous, preying entirely on macro-invertebrates. If herbicide was to reach the aquatic environment a reduction in aquatic vegetation and phytoplankton could occur, which could cause a trophic cascade (i.e., a shift in the food chain), resulting in reduced aquatic invertebrate herbivore prey base for fish. Mechanical and grazing methods for weed removal could temporarily increase sedimentation due to ground disturbance in the riparian area. The impacts from alternatives B, C, and D would likely be a localized and small in scale. Therefore, the proposed action is not expected to decrease population viability or cause a trend to federal listing of RGCT.

Management Indicator Species	Alternative A No Action	All Weed Management Alternatives: B, C, and D
Resident trout	Weeds would continue to displace native plants and grasses within riparian, so habitat quality and perennial water quality would decline.	With design features in place the proposed action may have an indirect impact to individuals of the resident trout. Resident trout is carnivorous, preying entirely on macro-invertebrates. If herbicide was to reach the aquatic environment a reduction in aquatic vegetation and phytoplankton could occur, which could cause a trophic cascade (i.e., a shift in the food chain), resulting in reduced aquatic invertebrate herbivore prey base for fish. Mechanical and grazing methods for weed removal could temporarily increase sedimentation due to ground disturbance in the riparian area. The impacts from alternatives B, C, and D would likely be a localized and small in scale. Therefore, the proposed action is not expected to decrease population viability or cause a trend to federal listing of resident trout.
Aquatic macro-invertebrates	Weeds would continue to displace native plants and grasses within riparian, so habitat quality and perennial water quality would decline.	If herbicide was to reach the aquatic environment a reduction in aquatic vegetation and phytoplankton could occur, which could cause a trophic cascade (i.e., a shift in the food chain), resulting in reduced aquatic invertebrate abundance. Increased sedimentation from mechanical and grazing alternatives could impact aquatic macro-invertebrates by filling interstitial spaces in the substrate where these organisms dwell. Sessile species would be most likely impacted. However, the impacts from alternatives B, C, and D would likely be a localized and small in scale. Therefore, the proposed action is not expected to decrease population viability of aquatic macro-invertebrates.

Cumulative Effects to Management Indicator Species

Because there are no measurable direct or indirect impacts to population or habitat trend for any management indicator species, there would be no cumulative effects from this project. Even though there are no predicted negative impacts to population or habitat trends for management indicator species, some habitats would be improved as a result of the action alternatives. Incrementally combined with past, present, and foreseeable actions such as restoration projects (e.g., Southwest Jemez Mountains Landscape Restoration Project) on the two national forests, there would be an improvement to habitat at a landscape level.

Affected Environment for Threatened and Endangered Species

This section analyzes threatened or endangered wildlife species listed under the Endangered Species Act. Threatened, endangered, and sensitive plants are addressed in the "Vegetation" section. For purposes of this analysis, the affected environment includes the species actually found on the forests and the habitats they occupy or are suitable for occupation. The list of species was developed from information provided by the U.S. Fish and Wildlife Service.

No analysis for the following species is required. The Arkansas River shiner (threatened), piping plover (threatened), and black-footed ferret (endangered) do not occur or have habitat on either forest. The least tern (endangered) has only been found near Bitter Lake National Wildlife Refuge, approximately 190 miles southeast of the Santa Fe National Forest. The Rio Grande silvery minnow is extirpated on the Santa Fe National Forest. Cochiti Reservoir is a permanent barrier to its upstream movement, and no critical habitat for it exists on either national forest.

Table S-34 identifies the species known to be present on the Carson and Santa Fe National Forests and critical habitat if present, each species' status, habitat, and estimated acres of habitat and acres of weeds within the habitat.

Mexican Spotted Owl (*Strix occidentalis*) and Critical Habitat

The Mexican spotted owl's nesting and roosting habitat is characterized by steep topography, cool shady canyons, and mature mixed conifer forest having high canopy closure. Protected activity centers are established to protect the territories of individual Mexican spotted owls. Owls also use ponderosa pine and other vegetation types for foraging. The Carson National Forest has very limited areas that are suitable for Mexican spotted owl with only one protected activity center on the Jicarilla Ranger District. Less than 1 acre of weeds has been found in this protected activity center.

Mexican spotted owl critical habitat is defined as suitable habitat found within critical habitat units that are expected to provide the "primary constituent elements" for the owl. Primary constituent elements essential to the conservation of the Mexican spotted owl include those physical and biological features that support nesting, roosting, and foraging. Critical habitat is limited to areas that meet the definition of "protected" and "restricted" habitats, as described in the recovery plan (USDI Fish and Wildlife Service 1995). Excluded from the designation of critical habitat are those areas in restricted habitat that do not contain the primary constituent elements.

Table S-34. Threatened or endangered wildlife species

Species	Federal Status / National Forest	Habitat	Estimated Acres of Habitat[1]	Acres of Known Weed Infestations[2]	Percent of Habitat Infested by Weeds
Jemez Mountains salamander	Endangered / Santa Fe	Forested areas within Valles Caldera and within 5 miles of Valles Caldera boundary above 6,900 ft. except for grasslands and piñon-juniper	8,681 (occupied)	15 (occupied)	0.2
Critical Habitat	Santa Fe	Specific areas with the defined habitat.	56,779	142	0.3
Mexican spotted owl *(Strix occidentalis lucius)* PACs	Threatened/ Carson & Santa Fe	Old growth and mature mixed conifer habitat, narrow mesic canyons	33,182 (SF) 600 (C)	31 (SF) >1 (C)	0.09 (SF) 0.2 (C)
Critical Habitat		Refer to project record for description	198,889 (SF) 23,275 (C)	660 (SF) 297 (C)	0.33 (SF) 1.3 (C)

Species	Federal Status / National Forest	Habitat	Estimated Acres of Habitat[1]	Acres of Known Weed Infestations[2]	Percent of Habitat Infested by Weeds
Southwestern willow flycatcher *(Empidonax traillii extimus)* Critical Habitat	Endangered Carson	Low gradient riparian with open water and well-developed willow patches. Dense riparian vegetation along with well-developed willow patches along the Rio Grande del Rancho.	148	27	0.2

1. Acres of habitat are based on a combination of habitat type, known areas of occupancy, and/or proximity to habitat features.
2. Acres of weed infestations are populations known as of August 1, 2013. Comprehensive surveys of both national forests have not been completed.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*) and Critical Habitat

The southwestern willow flycatcher nests in dense riparian vegetation including box elders, saltcedar, and willows. Nest sites have been found in pure stands of saltcedar in New Mexico. However, the species prefers more diverse native riparian vegetation that includes willow and cottonwood. It is known to occur in Rio Arriba and Sandoval Counties (BISON-M).

The species is not federally listed in the Santa Fe National Forest. The flycatcher has been found in two locations on the Carson National Forest, within critical habitat on the Camino Real Ranger District in Peñasco, New Mexico.

Southwestern willow flycatcher critical habitat is defined as suitable habitat found within flycatcher critical habitat units that is expected to provide the “primary constituent elements” for the flycatcher. The primary constituent elements essential to the conservation of the southwestern willow flycatcher include those physical and biological features that support feeding, sheltering, and cover while breeding and migrating. Southwestern willow flycatcher constituent elements of critical habitat are found in the riparian ecosystem within the 100-year floodplain or flood prone area. The final rule in the Federal Register (78 FR 344) identifies primary constituent elements.

Environmental Consequences to Threatened and Endangered Species

Effects of weed treatments described for all wildlife habitat and populations on the forests apply to threatened and endangered species. Table S-35 provides additional disclosures of estimated effects of each alternative for each threatened or endangered species. Effects are generally the same for all action alternatives other than the minor differences noted in the general wildlife effects, such as the slower rate of native vegetation recovery under alternative C. Also under alternative C, the low risk of impacts to individual animals from herbicides would be eliminated, and under alternative D, the low risk of impacts to individual animals from mechanical treatments would be eliminated. Action alternatives would not be likely to affect threatened or endangered species based on previous consultations with the U.S. Fish and Wildlife Service (Carson National Forest Consultation # 2-22-00-I-237 and Santa Fe National Forest Consultation # 2-22-00-I-324) in 2005 (USFWS 2005).

Mexican Spotted Owl and Critical Habitat

With design features in place alternative B, the preferred alternative, may affect but is not likely to adversely affect, and may be beneficial to the Mexican spotted owl. Alternative B may affect but is not likely to adversely affect critical habitat.

These determinations are based on the predicted increase in prey species within potential foraging areas for the Mexican spotted owl. The design features for the action alternatives listed in chapter 2 would prevent adverse effects to Mexican spotted owl and critical habitat. The treatments would be short duration, low disturbance activities which would occur once or twice in a season (depending on size of the treatment area).

Southwestern Willow Flycatcher and Critical Habitat

With design features in place the proposed action may affect but is not likely to adversely affect the Southwestern willow flycatcher. For example, surveys would be performed if the proposed treatment would occur when flycatchers may be present in the area. If the flycatcher were found during the surveys, treatment would not take place until the birds have completed nesting and their young have dispersed. Further, the effects of treatment would last a year or less or to the end of the next growing season.

Implementation of alternative C would rely on mechanical treatments that when implemented in riparian areas could result in greater change in in the short-term vegetation structure when compared to alternatives B or D.

Table S-35. Effects to and determinations for threatened or endangered species

Threatened or Endangered Species	Alternative A- No Action	Alternatives B, C, and D (All Weed Management Alternatives)
Jemez Mountains salamander	Weeds would continue to reduce vegetative invertebrate habitat used by the salamander as prey, thereby reducing the Jemez Mountains salamander prey base.	No effect. No treatments would occur when the Jemez Mountains salamander comes above ground after several consecutive days of rain. Herbicide treatments are not effective and would not be used in these conditions. The treatments of grubbing, hand pulling or controlled grazing (goats) would also not take place during the period when there is a risk to the JMS because it is above ground and could be inadvertently stepped on.
Jemez Mountains salamander critical habitat	Weeds would continue to invade critical habitat making the surface inhospitable or inaccessible due to root density or dead plant litter.	May affect, but not likely to adversely affect with an overall beneficial effect because treatments would improve the habitat of the invertebrate prey of the Jemez Mountains salamander.
Mexican spotted owl (threatened)	Weeds would continue to reduce native understory vegetation used by owl’s prey, thereby reducing the owl’s prey base.	May affect, but not likely to adversely affect with an overall beneficial effect because treatments would improve the habitat of the prey the owl feeds on. Negligible negative effects would be expected given the design features that avoid disturbing owls during the breeding season.
Mexican spotted owl critical habitat	Weeds would continue to displace native understory vegetation. The characteristics of critical habitat that favor prey	May affect, but not likely to adversely affect with an overall beneficial effect because treatments would improve the habitat.

Threatened or Endangered Species	Alternative A- No Action	Alternatives B, C, and D (All Weed Management Alternatives)
	habitat would be changed.	
Southwestern willow flycatcher (endangered)	Weeds would continue to displace the native riparian vegetation that flycatchers prefer.	Treatments would improve native willow and cottonwood riparian habitats preferred by willow flycatchers. During treatments, some loss of existing vegetation would occur and could reduce suitability for use by flycatchers until native vegetation is reestablished. There would be a very low risk that some individual birds could be impacted by any treatments given the design features requiring surveys prior to treatments in potential habitat.
Southwestern willow flycatcher critical habitat	Weeds would continue to displace native riparian vegetation within critical habitat.	No effect to critical habitat because the elements that compose it will not be changed.

Cumulative Effects to Threatened and Endangered Species

Because there would be no negative direct or indirect effects to threatened or endangered species due to the design of the project, there would be no cumulative adverse effects. The action alternatives, however, are expected to have beneficial direct and indirect effects to native habitats. Combined with other projects that would improve habitats, such as the Southwest Jemez Mountains Landscape Restoration Project, there would be an overall cumulative beneficial effect to threatened and endangered species habitats.

Affected Environment for Sensitive Wildlife Species

The effects common to all species apply to the sensitive species described in this section. For purposes of this analysis, the affected environment includes the species actually found on the national forests and the habitats they occupy or are suitable for occupation. The list of species in the project area was developed from the 2013 list of sensitive animals and plants (USDA Forest Service, Southwestern Region, 2013). Sensitive aquatic species are discussed in the “Fisheries and Aquatics” section of this chapter. Acres of habitat come from GIS analysis through vegetative cover types and local specialists’ knowledge. The weed populations are those known as of August 1, 2013. Detailed descriptions of the species’ habitats and life histories are located in the project record. The roundtail chub does not occur on either national forest; thus, it will not be discussed further. The Canada lynx’s habitat is high elevation spruce fir in Colorado, where it was introduced. It is not historically known to occur on either national forest and will not be discussed further.

The next tables display each sensitive species, the national forest(s) it is found on, its habitat, the amount of habitat, and the acres of habitat with weeds. Where two numbers exist in a cell, the top number represents the Santa Fe National Forest and the bottom number represents the Carson National Forest.

Table S-36. Sensitive species - amphibians

Species Name	National Forest	Habitat	Estimated Acres or Miles of Habitat	Acres of Known Weed within Habitat	Percent of Habitat with Weeds
Northern	Santa Fe	Associated with	40,790	1,882	4.6

Species Name	National Forest	Habitat	Estimated Acres or Miles of Habitat	Acres of Known Weed within Habitat	Percent of Habitat with Weeds
leopard frog *(Rana pipiens)*	Carson	water	24,784	1,682	6.8
Western boreal toad *(Bufo boreas boreas)*	Carson	High elevation lakes and forests. Reintroduced in one location 2008.	31,447	12	0.04

Table S-37. Sensitive species - birds

Species Name	National Forest	Habitat	Estimated Acres or Miles of Habitat	Acres of Known Weed Infestations within Habitat	Percent of Habitat Infested with Weeds
American peregrine falcon[1] *(Falco peregrines anatum)*	Santa Fe Carson	High cliffs with horizontal breaks for nest ledges	89,213	1,063	1.2
Bald eagle *(Haliaeetus leucocephalus)*	Santa Fe Carson	Riparian areas along major river corridors, but winter habitat is not always associated with riparian areas.	20,252 37,364	355 100	1.8 0.3
Boreal owl *(Aegolius funereus)*	Santa Fe Carson	High elevation mature spruce fir forests	193,548 179,652	620 52	0.3 0.03
Burrowing owl (Western) *(Aegolius funereus)*	Santa Fe Carson	Prairie dog towns	61,301 73,863	581 471	1.0 0.6
Gray vireo *(Vireo vicinior)*	Santa Fe Carson	Juniper grasslands with shrub component	178,430 119,437	919 951	0.5 0.8
Northern goshawk *(Accipiter gentilis)*	Santa Fe Carson	Most mature forested habitats except piñon-juniper	24,867 7,247	174 13	0.7 0.2
Western yellow-billed cuckoo[2] *(Coccyzus americanus Occidentalis)*	Santa Fe Carson	Riparian areas along river systems in cottonwood forest.	639 1,006	10 33	1.6 3.3
White-tailed ptarmigan *(Lagopus leucurus)*	Santa Fe Carson	Alpine areas	136,685 48,513	3 9	0.002 0.02

1. Habitat, including the known 12 post-fledging areas, for the peregrine falcon on the Carson National Forest has not yet been mapped. The effects, however, would be the same as for that described for the Santa Fe National Forest.
2. Indicates candidate species for Federal listing as threatened or endangered.

Table S-38. Sensitive species - mammals

Species Name	National Forest	Habitat	Estimated Acres or Miles of Habitat	Acres of Known Weed Infestations within Habitat	Percent of Habitat Infested with Weeds
Cinereus (masked) shrew *(Sorex cinereus cinereus)*	Santa Fe Carson	Riparian areas in sub-alpine coniferous forest in Sangre de Cristo, Jemez, and San Juan mountains unusually above 9,500 feet	262,024 260,291	695 52	0.3 0.02
Preble's shrew *(Sorex preblei)*	Santa Fe	Near permanent or intermittent streams in arid to semi-arid shrub or grassland or lesser into conifer forest	60,153	1,896	3.2
American water shrew *(Sorex palustris navigator)*	Santa Fe Carson	Permanent streams, seldom below 8,000 feet	60,153 37,997	1,896 1,083	3.2 2.9
Spotted bat *(Euderma maculata)*	Santa Fe Carson	Rock cliffs	60,153 37,397	1,896 1,803	3.2 4.8
Pale Townsend's big-eared bat *(Corynorhinus townsendii pallescens)*	Santa Fe Carson	Caves, mines or abandoned buildings	267,638 293,153	1,568 193	0.6 0.07
American marten *(Martes americana origenes)*	Santa Fe Carson	High elevation spruce-fir forests	263,881 318,454	928 104	0.4 0.03
Gunnison's prairie dog* *(Cynomys gunnisoni)*	Santa Fe Carson	Mountain meadows Valley floors and plains	1,214 51,465	205 814	16.9 1.6
Pika *(Ochotona princeps saxatilis)*	Santa Fe Carson	Talus slopes in Pecos Wilderness in Santa Fe NF and locations within and outside Pecos wilderness on the Carson NF	86,326 48,513	0.03 9	0.00004 0.02
Goat Peak pika *(Ochotona princeps nigrescens)*	Santa Fe	Talus slopes in the Jemez Mountains around the Valles Caldera National Preserve and west side of Los Alamos County	86,326	0.03	0.00004

Species Name	National Forest	Habitat	Estimated Acres or Miles of Habitat	Acres of Known Weed Infestations within Habitat	Percent of Habitat Infested with Weeds
New Mexico meadow jumping mouse***** *(Zapus hudsonius luteus)*	Santa Fe Carson	Wet meadows with tall grass in the Jemez and Sangre de Cristo Mountains	18,158 7,554	821 377	4.5 5.0

* Indicates candidate species for Federal listing as threatened or endangered.

Table S-39. Sensitive species - snail

Species Name	National Forest	Habitat	Estimated Acres or Miles of Habitat	Acres of Known Weed Infestations within Habitat	Percent of Habitat Infested with Weeds
Ruidoso snaggletooth (*Gastrocopta ruisdsensis*)	Santa Fe	Found on bare soil, under stones, and in thin accumulations of grass thatch and juniper litter on mid-elevation carbonate cliffs and xeric limestone grasslands along the eastern slopes of the Sangre de Cristo and Sacramento mountains in eastern New Mexico, where the only extant occurrences are.	16,912	16	0.1

Environmental Consequences to Sensitive Wildlife Species

Effects of weed treatments described for all wildlife habitat and populations on the forests apply to sensitive species. All the action alternatives would treat less than 0.1 percent (and in most cases, much less than that) of the species' habitat in a given year. This means that the species would still have the vast majority of its range to forage and breed in. The disturbance caused by weed treatments, already composing a very low percentage of total habitat, would last a season or less; the long-term result of reducing weed populations is expected to be beneficial to sensitive species by preventing weed expansion in native habitat. As a result, none of the action alternatives are expected to cause negative effects to the species or its habitat. The proposed action is not expected to cause a trend towards Federal listing for any sensitive species.

Amphibians

Effects to all sensitive amphibians are listed in table S-40. The proposed action (alternative B) is not expected to decrease population viability or cause a trend to federal listing.

Table S-40. Sensitive species: Effects to amphibians

Species	Alternative A (No Action)	Alternatives B, C, and D (All Weed Management Alternatives)	Reason for Determination
Northern leopard frog	There would be an increased loss of riparian and aquatic habitat. Weeds would continue to spread within this habitat decreasing the suitability of the habitat for the Northern leopard frog.	With design features for riparian and aquatic habitats in place, none of the action alternatives will have an impact to the impact to the frog.	The proposed action would not contribute to the primary threats to this species, which are: changes in wetlands, especially the alteration of marshy ponds to reservoirs; stocking of predatory fish; natural local extinctions as ponds dry up during years of low precipitation; and predation and competition by introduced bullfrogs (BISON-M).
Western boreal toad	There would be an increased loss to riparian and aquatic habitat near the Trout Lakes. Weeds would continue to spread within this habitat thus decreasing the suitability of the habitat for the boreal toad.	With design features for riparian and aquatic habitats in place, none of the action alternatives will have an impact to the toad.	Recent surveys indicate that it is possible that the species has declined in New Mexico in recent years, and is believed to be extirpated. The design features for riparian areas would prevent any negative effects to the toad or its habitat.

Birds

Effects to all sensitive bird species are listed in table S-41. The proposed action (alternative B) is not expected to decrease population viability or cause a trend to federal listing.

Table S-41. Sensitive species: Effects to birds

Species	Alternative A (No Action)	Alternatives B, C, and D (All Weed Management Alternatives)	Reason for Determination
American peregrine falcon	Nest habitat would not be affected. Cliff nesting areas are do not have weeds but protected zones around the nesting areas could be subject to a slow decline in prey as its habitat becomes more unsuitable due to the spread of weeds.	Protection zones (A – D, with increased protections the closer to the nest site) are established for each next site. Activities are subject to restrictions according to zone. With these in place, none of the alternatives will have an impact to the falcon.	Falcon habitat is primarily cliffs, where weeds do not tend to occur. Treatments would occur in less than 0.1% of foraging habitat in a given year.
Bald eagle	Increased loss of riparian habitat as weed tree species displace the cottonwoods used as roosting trees and hunting perches. Weed trees do not grow large enough for eagle use. Decreased use of the winter habitat on the two national forests.	The bald eagle is only present during winter months (Nov. through Mar.). No treatments of any type would not take place in winter to avoid disturbance to the eagle. Identification of herbaceous invasive species would be extremely difficult to impossible. Prescription burns (except burning of piled material in designated areas) will not be done in riparian habitat used by the eagle because of the detrimental effects of fire to large cottonwoods. Treatments that restore or protect native vegetation (planting of cottonwoods and willow) over the long term benefit the eagle.	The design features specifically for the bald eagle would prevent negative impacts to the eagle or its habitat.
Boreal owl	No impacts are expected to the Boreal owl because Boreal owl habitat is highly remote (not very affected by weeds) and under snow in breeding season.	No impacts are expected to the Boreal owl because its habitat is highly remote and under snow in breeding season	Boreal owl habitat is remote and under snow in breeding season in early spring. Treatments could not occur in the habitat until late in the season when hatchlings have fledged.

Species	Alternative A (No Action)	Alternatives B, C, and D (All Weed Management Alternatives)	Reason for Determination
Burrowing owl (western)	There would be a slow decrease in acres of prairie dog towns (prey) due to increased weed cover. Available nesting areas for the owl would decrease leading to a lower population or abandonment of currently used areas.	No impacts to the owl are expected with the design features in place.	Burrowing owls have only been located on the Carson. Some treatments, such as grazing and prescribed fire, would improve habitat for burrowing owls.
Gray vireo	Slow decrease of understory preferred by the vireo for nesting and foraging for invertebrate prey. Habitat will become less sustaining for the species.	No impacts to the gray vireo are expected with the design features in place.	Habitat is scattered and sparse. As displayed in the vegetation section, weed treatments are not expected to affect piñon-juniper habitat that this species depends on.
Northern goshawk	Slow decrease in habitat quality as the prey species food base is decreased by weeds.	No impacts to the goshawk are expected with the design features in place. Treatments would not occur in breeding habitat during breeding season around nest sites or on post-fledging areas.	With design features in place the proposed action will have no impact to the northern goshawk because treatments would not occur in breeding habitat during breeding season.
Western yellow-billed cuckoo	Continued decline in the extremely limited riparian cottonwood willow forest required by the cuckoo for nesting.	No impacts are expected to the western-yellow billed cuckoo because treatments would not occur during breeding season. Removal of nonnative invasive shrubs would improve the cuckoo’s habitat.	One of the greatest factors affecting the yellow-billed cuckoo has been the invasion of exotic woody plants into southwest riparian systems; the proposed action would remove these exotics.
White-tailed ptarmigan	Slow decrease of forbs preferred by ptarmigan for food. Habitat will become less sustaining for the species.	With the design features in place no impacts are expected to the white-tailed ptarmigan. Less than 0.001% of its habitat would be treated, leaving most of its range undisturbed.	Ptarmigan habitat is extremely high elevation and is cold most of the year; treatments would only occur for short periods. Design features avoid disturbance during the nesting period are in place.

Mammals

Effects to all sensitive mammals are listed in table S-42. The proposed action (alternative B) is not expected to decrease population viability or cause a trend to federal listing.

Table S-42. Sensitive species: Effects to mammals

Species	Alternative A (No Action)	Alternatives B, C, and D (All Weed Management Alternatives)	Reason for Determination
Cinereus (masked) shrew	Impacts are not expected immediately as Cinereus shrew feeds on insects. Weed populations increasing in the habitat would likely lead to decreased prey insects therefore less food available.	With the design features in place, no impacts to the Cinereus shrew are expected.	This shrew is mainly at high elevation wet meadows / marsh areas. Weeds are uncommon in these habitats. Activities for weed control would be occasional and not cause a negative impact to the habitat of the shrew.
Preble's shrew	Impacts are not expected immediately as Preble's shrew feeds on insects. Weed populations increasing in the habitat would likely lead to decreased prey insects therefore less food available.	With the design features in place, no impacts to the Preble's shrew are expected.	This shrew is mainly at lower elevation in sage scrub areas. Weeds are uncommon in this habitat. Temporary activities for weed control would be occasional and not cause a negative impact to the habitat of the shrew. This shrew has only been found on the Santa Fe NF in Sandoval County.
American water shrew	Habitat could decrease as water quality decreases from sediment not captured by weeds before it reaches a stream.	With the design features in place, no impacts to the American water shrew are expected.	Water shrews feed on small minnow and insects in the water. Protecting water quality by removing weeds helps protect the habitat of the shrew.
Spotted bat	Cave and cliff crevices do not support weeds, so no effect if the project did not occur.	Bat habitat is cave and crevices on cliff faces. No treatments would occur in these areas.	This species is rare throughout its range, indicating that its scarcity in NM may be due to biology rather than due to other impacts (NMDGF 2006). This, combined with the design features, means that weed treatments are not expected to impact the species.
Pale Townsend's big-eared bat	Cave and cliff crevices do not support weeds, so no effect if the project did not occur.	No impacts are expected to the pale Townsend's big eared bat because its main threats are habitat loss, cave vandalism and disturbance by cave explorers at maternity and hibernation roosts. The design features associated with this project would prevent disturbance from the people conducting treatments.	The occurrence of this bat is correlated strongly with the availability of caves or cave-like roosting habitat (mines, buildings, snags, etc. (Perkins and Schommer 1992), which are highly sensitive to disturbance and the presence of people. Weed treatments would not take place in roosting habitat because weeds don't grow in them. The design features would prevent disturbance to the bat.

Species	Alternative A (No Action)	Alternatives B, C, and D (All Weed Management Alternatives)	Reason for Determination
American marten	Indirect impacts to the marten would occur slowly as weeds decrease habitat quality for its prey species.	No impacts to the marten are expected because its main threats are timber harvest, trapping, snag removal and firewood collection. This project does not propose any of those activities.	This project doesn't propose any activities listed by scientific studies as the main disturbance factors to the marten.
Rocky Mountain bighorn sheep	Impacts are not expected as bighorn sheep feed on a diversity of plants and will avoid those weeds which are toxic. Only very small amounts of weeds would be expected to survive in their high elevation habitat.	No impacts to the bighorn sheep are expected because weeds aren't expected to thrive at these high elevations, so very little of its habitat would be treated on an annual basis. Goats are prohibited within bighorn sheep habitat by a permanent Closure Order to avoid introducing disease to the bighorn sheep population.	Same as at left.
Gunnison's prairie dog	Impacts are not expected immediately as Gunnison's prairie dog feed on common grasses and plants, avoiding those weeds which are toxic. Weed populations increasing in dogtowns would likely lead to decreased health and loss of prairie dogs or abandonment of the dogtown.	No impacts to Gunnison's prairie dog are expected because its main threats include predation, man and habitat loss, as well as sylvatic plague (BISON-M). This project would improve habitat by increasing native plants that compose its habitat.	Same as at left.
American pika	Pika feed on common grasses within their high elevation talus slope habitat. They cut and store grass to dry as hay for winter food. Weed populations would be expected to be small within the talus slopes. No increase in weeds and therefore no decrease in grasses are expected within the rocky high elevation habitat.	American pika inhabits high elevation rocky slopes in the Sangre de Cristo Mountains at elevations above approximately 10,000 feet. This species is an herbivore (BISON-M). No impacts to the pika are expected because treatments would not occur in its habitat – rocky, talus slopes. The pika isn't expected to be subject to disturbance from treatment. The proposed action would not be expected to decrease population viability or cause a trend to federal listing of this species.	No disturbance to the pika from treatments is expected (see left). Weeds are generally not consumed by the pika as the preferred forage is grass.

Species	Alternative A (No Action)	Alternatives B, C, and D (All Weed Management Alternatives)	Reason for Determination
Goat Peak pika	Goat Peak pika feed on common grasses within their high elevation talus slope habitat. They cut and store grass to dry as hay for winter food. Weed populations would be expected to be small within the talus slopes. No increase in weeds and therefore decrease in grasses are expected within the rocky high elevation habitat.	Same as the American pika.	Same as American pika.
New Mexico meadow jumping mouse	The jumping mouse feeds on seeds of the riparian grass community. They depend on tall grasses in the narrow riparian zone. Weeds spreading within this habitat will decrease the suitability of the habitat. Weed populations would be expected to be robust and increase with constant soil moisture thus lessening the survival chances of the mouse.	Design features for riparian areas, the mouse's habitat, would ensure the mouse would have no impacts from herbicides. Only small amounts of habitat would be treated each year within the riparian habitat of the mouse. Small areas can be treated by hand pulling or grubbing depending on the weeds species. Native vegetation would be avoided by identification before treatment. Only small amounts of habitat would be treated each year within the riparian habitat of the mouse. Design features for riparian areas would be in place to protect the habitat. The mouse hibernates below ground for nearly 9 months and emerges in July. Any treatments would take place before the mouse emerged from hibernation in July. The proposed action would not be expected to decrease population viability or cause a trend to federal listing of this species.	All treatments in the riparian habitat are unlikely to affect the mouse while it is underground in hibernation. Design features for riparian areas would be in place to protect the habitat. Over grazing and catastrophic fire resulting in damaging floods have had the most significant impact to the habitat of the mouse.

Snail

Effects to the sensitive snail are listed in table S-43. The proposed action (alternative B) is not expected to decrease population viability or cause a trend to federal listing.

Table S-43. Sensitive species: Effects to snail

Species	Alternative A (No Action)	Alternatives B, C, and D (All Weed Management Alternatives)	Reason for Determination
Ruidoso snaggletooth	Impacts not expected as this snail feeds on dead or decaying plant material. Weeds in limestone habitat are low to none.	Wildfire is the biggest threat to the snail because of the loss of cover and vegetative substrate in its habitat. This snail lives near limestone outcroppings where weed treatments are unlikely to occur. Since the snail feeds on dead or decaying plants its food sources wood not be treated.	No impacts are expected to the Ruidoso snaggletooth. Design features will avoid impacts to the snail. The proposed action would not be expected to decrease population viability or cause a trend to federal listing of this species.

Cumulative Effects – Sensitive Species

Because there would be no measurable direct or indirect effects to sensitive species as a result of the protective design features being in place, there would be no cumulative effects.

Affected Environment for Migratory Birds

Presidential Executive Order 13186 (January 2001) requires that unintentional take of migratory birds reasonably attributable to agency action be disclosed, and the effects to migratory bird populations be determined, with emphasis on species of concern that emphasizes conservation of neotropical migratory birds. The Forest Service analyzes impacts of proposed forest management activities by addressing the following: (1) effects to “highest priority” species as identified by New Mexico Partners in Flight, (2) effects to important bird areas, and (3) effects to important over wintering areas.

New Mexico Partners in Flight considers eight risk factors in identifying conservation priority species: (1) global abundance; (2) New Mexico breeding abundance; (3) global breeding distribution; (4) New Mexico breeding distribution; (5) threats to breeding in New Mexico; (6) importance of New Mexico to breeding; (7) global winter distribution; and (8) threats on the wintering grounds. Species with the highest risk factors are classified as “highest priority” for conservation action. This evaluation addresses general effects to migratory birds, and specific effects to highest priority species for the main habitat types found in the project area.

Important Bird Areas. “Important Bird Area” is a designation created by National Audubon and Bird Life International[7] to recognize the importance of specific areas for breeding or migrating birds. The important bird areas in or near the Santa Fe National Forest and Carson National Forest are: Bandelier National Monument, Caja del Rio, Chama River Gorge/Golondrino Mesa, Randall Davey Audubon Center/TNC Santa Fe Preserve, Upper Rio Grande Gorge, and Valles Caldera National Preserve.

[7] http://iba.audubon.org/iba/siteSearch.do

Important overwintering areas are often large wetlands. Areas considered important on the two national forests include the Rio Chama, Rio Grande at White Rock Canyon, Upper Rio Grande Gorge and Pecos Canyon corridors. These areas provide wintering habitat for bald eagle.

Table S-44 lists highest priority migratory bird species that are either known to occupy or are likely to occur in the two national forests, based on appendix D of Partners in Flight and habitat on the forests.

Table S-44. Highest priority migratory birds and habitats used

Highest Priority Species	Primary Habitat
Black Swift	High elevation riparian woodland
Red-naped sapsucker	
Hammond’s Flycatcher	
Veery	
American Dipper	
MacGillivray’s Warbler	
Lewis’s woodpecker	Middle elevation riparian woodland
Red-headed woodpecker	
Brown-capped rosy finch	Alpine tundra
White-tailed ptarmigan	
Williamson’s sapsucker	Mixed conifer
Olive-sided flycatcher	
Dusky flycatcher	
Ferruginous hawk	Piñon-Juniper
Gray vireo	
Black-throated gray warbler	
Gray flycatcher	
Bendire’s thrasher	
Ferruginous Hawk	Plains and mesa grassland
Prairie Falcon	
Bendire’s Thrasher	
Long-billed curlew	
Lark bunting	
Lewis’s woodpecker	Middle elevation riparian woodland
Red-headed woodpecker	
Blue grouse	Spruce-fir
Boreal owl	
Flammulated owl	Ponderosa pine
Virginia’s warbler	
Grace’s warbler	
Bendire’s thrasher	Great Basin desert shrub
Sage sparrow	
Loggerhead shrike	
Sage thrasher	
MacGillivray’s warbler	Montane shrub
Green-tailed towhee	
Black swift	Cave/Rock/Cliff
Prairie falcon	

Environmental Consequences to Migratory Birds

Effects previously described for all wildlife habitat and populations on the forests apply to migratory birds. Table S-45 provides additional disclosures of estimated effects of each alternative for migratory birds. No unintentional take of migratory bird species is anticipated because any disturbance associated with treatment would be of short duration (less than a few days in a season) and on less than 0.1 percent of habitat, leaving the vast majority of forage and breeding habitat available. Over time, removal of weeds would promote native vegetation favorable to migratory birds.

Table S-45. Effects to migratory birds and habitats

High Priority Species	Migratory Bird Habitats	Alternative A (No Action)	Alternatives: B, C, D[1] (All Weed Management)
Black swift	High elevation riparian woodlands	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	No unintentional take of these species is anticipated or expected. Treatments would benefit these birds because native plants would become more abundant, improving plant diversity and habitat quality once weeds are eliminated or controlled. Native plants provide important food sources to species directly, as seeds, or for the prey species of predators. No impact to population or habitat trends are expected.
Red-naped sapsucker			
Hammond's flycatcher			
American dipper			
Veery			
MacGillivray's warbler			
Wilson's phalarope	Wet meadows	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	
Bobolink			
Brown-capped rosy finch	Alpine tundra	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality.	No unintentional take of these species is anticipated or expected. No treatments are likely to occur in this habitat, thus no impacts would be expected. Treatments would benefit these birds because native plants would become more abundant, improving plant diversity and habitat quality once weeds are eliminated or controlled. Native plants provide important food sources to species directly.
White-tailed ptarmigan			
Northern goshawk	Mixed conifer	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	No unintentional take of these species is anticipated or expected. Treatments would benefit these birds because native plants would become more abundant, improving plant diversity and habitat quality once weeds are eliminated or controlled. Native plants provide important food sources to species directly (seeds) or for the prey
Mexican spotted owl			
Williamson's sapsucker			
Olive-sided flycatcher			
Dusky flycatcher			

High Priority Species	Migratory Bird Habitats	Alternative A (No Action)	Alternatives: B, C, D[1] (All Weed Management)
Ferruginous hawk	Plains/mesa grasslands	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	species of predators. No impact to population or habitat trends would be expected.
Prairie falcon			
Bendire's thrasher			
Long-billed curlew			
Lark bunting			
Ferruginous hawk	Piñon-juniper	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	No unintentional take of these species is anticipated or expected. Treatments would benefit these birds because native plants would become more abundant, improving plant diversity and habitat quality once weeds are eliminated or controlled. Native plants provide important food sources to species directly, as seeds or for the prey species of predators. No impact to population or habitat trends would be expected.
Gray vireo			
Bendire's thrasher			
Black-throated gray warbler			
Gray flycatcher			
Lewis's woodpecker	Mid-elevation riparian woodland	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	
Red-headed woodpecker			
Blue grouse	Spruce/subalpine fir	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	No unintentional take of these species is anticipated or expected. Treatments would benefit these birds because native plants would become more abundant, improving plant diversity and habitat quality once weeds are eliminated or controlled. Native plants provide important food sources to species directly (seeds) or for the prey species of predators. No impact to population or habitat trends would be expected.
Boreal owl			
Flammulated owl	Ponderosa pine	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	
Virginia's warbler			
Black-throated gray warbler			
Bendire's thrasher	Great Basin desert shrub	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	No unintentional take of these species is anticipated or expected. Treatments would benefit these birds because native plants would become more abundant, improving plant diversity and habitat quality once weeds are eliminated or controlled. Native plants provide important food sources to species directly, as seeds, or for food species of prey for predators. No impact to population or habitat trends would be expected.
Sage sparrow			
Loggerhead shrike			
Sage thrasher			
Green-tailed Towhee	Montane shrub	Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting these birds.	

High Priority Species	Migratory Bird Habitats	Alternative A (No Action)	Alternatives: B, C, D[1] (All Weed Management)
Black Swift	Cave/rock/cliff	No weed infestations are known to occur in this habitat type.	No unintentional take of these species is anticipated or expected. No treatments are likely to occur in this habitat, thus no impacts would be expected. No impacts to population or habitat trends would be expected.
Important Bird Areas (IBA): Bandelier National Monument, Caja del Rio, Chama River Gorge / Golondrino Mesa, Caja del Rio, Randall Davey Preserve / Santa Fe Canyon Preserve, Upper Rio Grande Gorge and the Valles Caldera National Preserve.		The IBAs encompass all the habitat types from low elevation to upper elevation forest types. Weeds would continue to spread and the loss of native plants and plant diversity would reduce habitat quality, impacting birds that use these areas.	Treatments would benefit birds because native plants would become more abundant, preserving native plant diversity and habitat quality once weeds are eliminated or controlled. Native plants provide important food sources to species directly, as seeds, or for the prey species of predators. No impact to population or habitat trends would be expected.
Over-wintering Areas		Overwintering areas are associated with large river riparian areas. These areas are among the most heavily impacted by weeds such as saltcedar, which reduces habitat suitability for many migratory bird species.	Treatments reducing weeds such as saltcedar would maintain or enhance habitat quality and suitability of overwintering areas.

1. Assumes full compliance with design features, conservation and recovery plans, and other project requirements.

Cumulative Effects to Migratory Birds

The direct and indirect effects of this project would be short-term disturbance (less than 5 days) on less than 0.1 percent of habitat on an annual basis, leaving the vast majority of forage and breeding habitat available. Over time, the removal of weeds would promote native vegetation favorable to migratory birds. The direct and indirect effect to migratory birds would be immeasurable, and would not contribute any noticeable cumulative effect when added to other activities in the analysis area.

Effects of Forest Plan Amendment to All Wildlife Species

The proposed amendment to the Santa Fe National Forest Plan that allows weed treatment with herbicides in the currently restricted area of municipal watersheds, and on soils with a low revegetation potential would result in no long-term effects to wildlife resources presently or when future projects are implemented.

The language of the amendment for municipal watersheds would not affect riparian or aquatic resources because of the design features in place for areas near water.

The language of the amendment for soils would not affect wildlife because ground cover needs to be restored quickly, thereby providing forage or cover vegetation preventing soil loss.

The deletion of language for soils with moderate to high cation exchange would not affect wildlife. These soils would still need to be revegetated or treated for regrowth of minimal vegetation providing forage or cover.

The modifications proposed by the amendment with design features and protocols included have minimal short-term disturbance effects to individuals but would not affect populations. The amendment is not expected to cause any long-term impacts to wildlife during the implementation of future projects because the intent of weed treatment is to preserve, restore, or improve habitat quality. Future projects in treatment areas would be analyzed at the appropriate level of NEPA for potential effects to wildlife.

Fish and Aquatic Resources

[Replaces entire section]

Affected Environment for Fish and Aquatic Resources

The affected environment for fish and aquatic resources is San Juan, Arkansas, and Rio Grande River basins in northern New Mexico (refer to the "Water Resources" section for a map and description of watersheds). Forty-eight of the 55 project watersheds have weeds infestations, the majority of which are found along roads and within 300 feet of perennial streams. Riparian areas (terrestrial habitat directly adjacent to streams) support a highly diverse assortment of both plant and animal species (Naiman et al. 1993). The ability of a nonnative species to establish in an area outside of its native range in areas with high diversity can be greater than in less diverse areas (Planty-Tabacchi et al. 1996, Stohlgren et al. 1999), which is particularly important to consider in areas where high plant diversity is focused within the riparian zone, such as the arid southwest (Knopf et al. 1988). Riparian areas are vital to fish and aquatic resources because high-quality riparian and high-quality streams are analogous, meaning you must have one to have the other (Hynes 1975).

How Weeds Affect Fish and Aquatic Resources

The link between terrestrial environments and aquatic ecosystems can be difficult to understand, but the importance of streamside vegetation for stream health cannot be overstated. For example, the majority of productivity in mountain streams is the result of organic and nutrient inputs from surrounding areas (Cummins and Klug 1979, Vannote et al. 1980). Moreover, the deposition of leaf litter into streams can provide large quantities of consumable nutrients for a variety of aquatic insects (Wallace and Webster 1996), which, in turn, are consumed by insectivorous fishes (Sublette et al. 1990, Rinne 1995). Further, terrestrial invertebrates that fall from streamside vegetation into streams can constitute an important part of a fish's diet (Rinne 1995). Streamside vegetation is also critical for preserving the integrity of stream channels (Gran and Paola 2001) and reducing excessive bank erosion (Beeson and Doyle 1995). The ability to stabilize stream banks varies between vegetation types and species (Lyons et al. 2000). A combination of grasses, shrubs, and trees may be the best at reducing erosion because the roots of each extend to different depths; holding a greater portion of the soil profile in place (Zuazo and Pleguezuelo 2008).

Weeds threaten the composition of riparian plant and animal species. Weeds have three things in common: (1) they are habitat generalists, meaning they can do well in most environments; (2) they are highly adaptable to change; and (3) they have high reproduction rates, meaning they produce offspring early and often (Sakai et al. 2001). Native vegetation often cannot compete with successful invaders and can become extirpated from an area (Lodge 1993). As invasive plants continue to spread and out-compete native species, a dramatic shift in species composition can occur; shifting from a diverse community of plants to a monoculture with one species (Eiswerth and Johnson 2002).

As the riparian plant community changes, so too does the interaction between the vegetation and nearby stream. For example, deposition of leaf litter from an invasive shrub into an adjacent stream caused a four-fold decrease in aquatic insect abundance when compared to areas of native vegetation (Baily et al. 2001). Such a reduction in prey abundance could increase stress on fish and other insectivorous organisms. Additionally, a reduction in the variety of plants present could result in a less stable soil horizon, which could increase stream sedimentation because of stream bank erosion. Excessive sedimentation can reduce aquatic habitat for insects along the stream bottom, smother or damage fish eggs, and can cause damage to the gills of aquatic organisms because of abrasions (Newcombe and MacDonald 1991). It is important to note that only a few examples of how weeds may impact fish and aquatic resources are presented here and that other impacts from weeds may exist.

Forest Sensitive Aquatic Species Analysis and Habitat Information

The analysis of aquatic management indicator species appears in the “Wildlife” section of this chapter. In addition to being a management indicator species, the Rio Grande cutthroat trout is considered a Forest Service sensitive species and is also a candidate for listing under the Endangered Species Act, therefore, it will also be analyzed in this section. Table S-46 displays the Forest Service Southwestern Region sensitive aquatic species found on the Carson and Santa Fe National Forests, and lists their occupied or suitable habitats. A full species description is located in the project record.

Table S-46. Sensitive aquatic species found on the Carson and Santa Fe National Forests and occupied or suitable habitats

Species Name	National Forest	Habitat	Estimated Acres or Miles of Habitat	Acres of Known Weed Infestations within Habitat*	Percent of Habitat Infested with Weeds
Lilljeborg’s Pea-clam *Pisidium lilljeborg*	Santa Fe	Nambe Lake in the Pecos Wilderness, Santa Fe National Forest	0.1	0	0
Sangre de Cristo pea-clam *Pisidium sanguinichristi*	Carson	Only historical location is at Middle Fork Lake, Carson National Forest	8	0	0
Nokomis fritillary *Speyeria nokomis nokomis*	Carson	Wetlands associated with flowing water. Streamside meadows with an abundance of violets	37,398	1,803	4.8
Rio Grande chub *Gila pandora*	Santa Fe Carson	Headwater streams	SF = 1,822 C = (78)	SF = 298 C = (0.6)	SF = 16.4 C = 0.8
Rio Grande cutthroat trout *Onchoryncus virginalis clarkii*	Santa Fe Carson	Headwater streams	SF = 3,924 C = (138)	SF = 5 C = (1.8)	0.1 1.3
Rio Grande sucker *Catostomus plebius*	Santa Fe Carson	Headwater streams	SF = 2,235 C = (69)	SF = 367 C = (0.4)	16.4 0.6

* Acres of weeds located along linear miles of stream were calculated using a 66-foot buffer on each side of the aquatic habitat.

Lilljeborg's Pea-clam

The New Mexico population of the species occurs in Nambe Lake, which is located in a glacial cirque about 11,300 feet in elevation. The surrounding habitat includes rocky talus and stands of Englemann spruce.

Sangre de Cristo Pea-clam

The only known population of Sangre de Cristo Pea-clam occurs at Middle Fork Lake in the Sangre de Cristo Mountains of northern New Mexico at approximately 10,845 feet in elevation (Taylor 1987). Current population and distribution of this species are unknown.

Nokomis Fritillary Butterfly

The Nokomis fritillary (Blue black silverspot) butterfly is found in streamside meadows and open seepage areas with an abundance of violets generally surrounded by desert landscapes (Pyle 1976). No confirmed sightings of this species are documented on National Forest System lands. Potential threats include weeds, insecticides, and elimination of food sources by herbicides.

Rio Grande Chub

Rio Grande chub are native to the Rio Grande basin in New Mexico but is also found in the Pecos and Canadian River drainages. Rio Grande chub inhabits cold water streams, and uses undercut banks, brush, and woody debris for cover (Rinne 1995b). The greatest threats to this species include degraded and fragmented habitat, invasive fishes, and land use changes, which reduce natural stream function (Rees et al. 2005).

Rio Grande Cutthroat Trout

The Rio Grande cutthroat trout occurs in high-elevation mountain streams from south-central Colorado to southern New Mexico (Rinne 1995, Young et al. 2005). Rio Grande cutthroat trout occur in streams with clean gravel and cobble substrates, high habitat heterogeneity, and minimal influence from nonnative salmonid competitors (Harig and Fausch 2002). The greatest threats to this species include hybridization with nonnative trout, habitat degradation, and stream dewatering (Stefferud 1988).

Rio Grande Sucker

Rio Grande sucker typically occurs in low-gradient streams at middle (6,600-8,600 feet) elevations (Calamusso and Rinne 1996, Calamusso et al. 2002). The greatest threats to this species include competition from the nonnative white sucker (*Catostomus commersonii*) and habitat degradation (Calamusso et al. 2002).

Environmental Consequences – Fish and Aquatic Resources

Methodology

Scientific literature was reviewed to evaluate the effects of herbicide application on fish and aquatic species. Additionally, to evaluate the risk of herbicides reaching aquatic ecosystems at levels that would cause harm, a "worst-case scenario" model was created using picloram as the representative herbicide because of its mobility in soil. The model used alternative D (herbicide only) and assumed that all weed infestations (as of 2005) would be treated in the same year rather than being spread out over the next 10 years. The amount of picloram entering aquatic ecosystems with surface water runoff and overland flow after terrestrial application was modeled in the 11 representative watersheds (refer to appendix 5 of the FEIS).

Table S-47. Environmental consequences and determinations for fish and aquatic species

Species	Alternative A (No Action)	Alternatives B, C, and D (All Weed Management Alternatives)	Reason for Determination
Lilljeborg's pea-clam	No impacts are expected because no known populations of weeds are found around Nambe Lake.	No impacts to the Lilljeborg's Pea-clam or its habitat are expected because no treatments would take place in or around the lake.	The design features that limit the use of certain herbicides in riparian environments would prevent adverse impacts to this species. Otherwise, no other kinds of treatments would occur around Nambe Lake itself so there would be no effect to the clam.
Sangre de Cristo pea-clam	No impacts are expected because no known populations of weeds are found around Middle Fork Lake.	No impacts to the Sangre de Cristo pea-clam or its habitat are expected because no treatments would take place in or around the lake.	The design features that limit the use of certain herbicides in riparian environments would prevent adverse impacts to this species. Otherwise, no other kinds of treatments would occur around Middle Fork Lake in the lake itself so there would be no effect to the clam.
Nokomis fritillary	If left untreated, the Nokomis fritillary butterfly's food base may shift from native to nonnative vegetation. As this butterfly continues to forage it could inadvertently pollinate nonnative plants, which would perpetuate the spread of undesirable weeds.	With design features in place the proposed actions may have an impact on the butterfly or its habitat. However, the unintentional application of herbicides to this species' preferred forage would be minimal because of targeted herbicide application. Mechanical and grazing alternatives would have a greater impact to this species and its habitat because precise treatment of weeds would be difficult. However, less than 5% of the species habitat is anticipated to be treated, therefore, the proposed actions are not expected to decrease population viability or cause a trend to federal listing of Nokomis fritillary butterfly.	The design features require hand application of herbicide in this species' habitat will greatly reduce the risk of accidental treatment of native plants. Furthermore, the scale at which weeds have infested Nokomis fritillary habitat is such that impacts from mechanical and grazing would be minimal.
Rio Grande Chub	Weeds would continue to displace native plants and grasses within riparian, so habitat quality and perennial water quality would decline.	With design features in place the proposed action may have an indirect impact to individuals of the Rio Grande chub. Rio Grande chub is carnivorous, feeding on zooplankton and aquatic insects. If herbicide was to reach the aquatic environment a reduction in aquatic vegetation and phytoplankton could occur, which could cause a trophic cascade (i.e., a shift in the food chain), resulting in reduced aquatic invertebrate herbivore prey base for fish. Mechanical and grazing methods for weed removal could temporarily increase sedimentation due to ground disturbance in the riparian area. The impacts from alternatives B, C, and D would likely be a localized and small in scale Therefore, the proposed actions are not expected to decrease population viability or cause a trend to federal listing of Rio Grande chub.	The design features for riparian areas are to avoid herbicide use within 50 feet on either side of streams of known Rio Grande chub occupancy during spawning season (March 1-July 31). Furthermore, design features specify the quantity, duration, and type of herbicides to be used near fish bearing streams, which would minimize negative impacts to Rio Grande chub. Additionally, ground disturbance from other alternatives would be localized and small in scale. Because treatments would occur outside of spawning season, no impacts to eggs would be expected. Fish are highly mobile and could temporarily seek better conditions if necessary.

Species	Alternative A (No Action)	Alternatives B, C, and D (All Weed Management Alternatives)	Reason for Determination
Rio Grande Cutthroat Trout	Weeds would continue to displace native plants and grasses within riparian, so habitat quality and perennial water quality would decline.	With design features in place the proposed action may have an indirect impact to individuals of the Rio Grande cutthroat trout. Rio Grande cutthroat trout is carnivorous, preying entirely on macro-invertebrates. If herbicide was to reach the aquatic environment a reduction in aquatic vegetation and phytoplankton could occur, which could cause a trophic cascade (i.e., a shift in the food chain), resulting in reduced aquatic invertebrate herbivore prey base for fish. Mechanical and grazing methods for weed removal could increase sedimentation due to ground disturbance in the riparian area. The impacts from alternatives B, C, and D would likely be a localized and small in scale. Therefore, the proposed actions are not expected to decrease population viability or cause a trend to federal listing of Rio Grande cutthroat trout.	The design features for riparian areas are to avoid herbicide use within 50 feet on either side of streams of known Rio Grande cutthroat trout occupancy during spawning season (March 1-July 31). Furthermore, design features specify the quantity, duration, and type of herbicides to be used near fish bearing streams, which would minimize negative impacts to Rio Grande cutthroat trout. Additionally, ground disturbance from other alternatives would be localized and small in scale. Because treatments would occur outside of spawning season, no impacts to eggs would be expected. Fish are highly mobile and could temporarily seek better conditions if necessary.
Rio Grande Sucker	Weeds would continue to displace native plants and grasses within riparian, so habitat quality and perennial water quality would decline.	With design features in place the proposed action may have an indirect impact to individuals of the Rio Grande sucker. Rio Grande sucker is omnivorous, feeding on both aquatic vegetation (i.e., algae) and aquatic invertebrates. If herbicide was to reach the aquatic environment a reduction in aquatic vegetation and phytoplankton could occur, which could negatively impact Rio Grande sucker my limiting available forage as well as cause a trophic cascade (i.e., a shift in the food chain), resulting in a reduced aquatic herbivorous invertebrate prey base for fish. Mechanical and grazing methods for weed removal could increase sedimentation due to ground disturbance in the riparian area. The impacts from alternatives B, C, and D would likely be a localized and small in scale. Therefore, the proposed actions are not expected to decrease population viability or cause a trend to federal listing of Rio Grande sucker.	The design features for riparian areas are to avoid herbicide use within 50 feet on either side of streams of known Rio Grande sucker occupancy during spawning season (March 1-July 31). Furthermore, design features specify the quantity, duration, and type of herbicides to be used near fish bearing streams, which would minimize negative impacts to Rio Grande sucker. Additionally, ground disturbance from other alternatives would be localized and small in scale. Because treatments would occur outside of spawning season, no impacts to eggs would be expected. Fish are highly mobile and could temporarily seek better conditions if necessary.

Alternative A – No Action

Weed infestations would go untreated under alternative A. This alternative would likely result in a greater abundance of undesirable plants on the two national forests. Weeds would continue to displace native plants and grasses within riparian areas, reducing forage, habitat, and water quality, which negatively affect fish and aquatic resources.

Effects of Ground Disturbance

There would be no sediment caused by ground-disturbing weed treatments under this alternative.

Effects of Herbicides

Since herbicides would not be applied under this alternative, no effects from herbicides to fish and aquatic resources would occur.

All Action Alternatives (B, C, and D)

For all the action alternatives, the proportion of weed infested habitat is small, and the proportion expected to be treated each year even smaller, which reduces the risk of impact to an individual organism from any treatments. Alternative C would eliminate the risk of herbicides and alternative D would eliminate the risk of impacts from ground-disturbing activities. Alternative B (combination of alternatives C and D) is expected to be the most successful at eradicating weed infestations. The treatment and eradication of weed populations on the two national forests would have long-term beneficial effects for fish and aquatic resources.

Effects of Ground Disturbance

Mechanical and grazing methods of weed control could increase sediment transport to streams; however, because of the small scale of most treatment areas, increased soil erosion would likely be within acceptable limits as described in the “Soil Resources” section. Land devoid of vegetation post treatment would be planted with native plant species, which will reduce the risk of erosion. Based on the analysis presented in the soil, water and vegetation section, along with design features to limit sediment transport, there would be a minimal increase in sediment delivery to streams, resulting in a low risk of impact to fish and aquatic resources.

Effects of Herbicides

With the design features in place, concentrations of herbicides and the duration of exposure on the aquatic environment would be small and well below levels at which chronic exposure effects are documented for aquatic organisms. The risk assessments for each herbicide formulation include a review of relevant information on an herbicide’s likely long-term effect, based on application rates used by the Forest Service. Furthermore, following label instructions and proper application procedures as outlined by the herbicide manufacturer greatly reduces the likelihood of herbicides reaching the aquatic system. If an herbicide was to reach the aquatic environment, however, a reduction in aquatic vegetation and phytoplankton could occur, which could cause a shift in the food chain, resulting in fewer prey for fish.

Results of "Worst-case Scenario" Analysis

This document analyzes three methods of potential contamination by herbicides: (1) leaching through soil to reach groundwater; (2) overland flow into water; or (3) accidental spills into water. The results of each are described next.

1. **Leaching through soil.** The risk of herbicides leaching through the soil into groundwater is low. Soils are rarely a receptor for herbicide application because herbicides would be sprayed directly on weeds and not the soil, meaning that little herbicide would touch soil in the first place. Herbicides on soil pose little risk to groundwater because chemicals typically disappear from the soil surface by plant uptake, volatilization, natural decomposition, or adsorption of the herbicide by soil particles. As Norris et al. (1991) indicates, leaching of chemicals through the soil profile is least likely to occur in undisturbed forest environments. The half-lives (the time it takes for half the active ingredient to degrade) of most of the herbicides are 24 to 48 hours in water. Finally, the herbicides that pose the greatest risk in aquatic environments would be prohibited from use near such environments (see table S-11, rows 41-42 and 46-49). For example, picloram would not be used in an aquatic environment or in areas having a shallow water table. Another feature limits herbicide use to a short-lived, nonleachable herbicide registered by EPA for use on permeable soils with shallow water tables. Monitoring the effects of treatments and effectiveness of design features would further reduce the risk of unexpected impacts over the life of this project.

2. **Overland flow.** No measurable impacts to aquatic organisms are expected as a result of overland flow of herbicides. The risk of herbicides being carried in water from rain or irrigation to aquatic systems varies depending on soil type and the timing and intensity of rain following an application. Studies show that the risk of herbicides entering aquatic systems from overland flow runoff tends to be lower on well-vegetated forests and rangelands. Norris et al. (1991) indicated that overland flow occurs infrequently on most undisturbed forest lands because the infiltration capacity of the forested soils is usually greater than the rate of precipitation. However, denuded and compacted soil, such as along roads, trails, and in campsites where many known weeds are located, have potential to allow surface runoff. High-severity wildfires reduce soil infiltration rates, increasing the magnitude of erosion and runoff. This effect is greatly diminished by the second year after a fire because vegetative recovery begins and soil erosion is reduced once the erosion rills break through the soil hydrophobic layer (DeBano 2000).

   The "worst-case scenario" modeling performed for this analysis assumed that all known weed infestations within Ponil Creek and Lower Jemez River watersheds would be treated in the same year. The results of the model determined that the level of herbicide that could potentially reach the water might exceed the "no effect" threshold. Because all weeds would <u>not</u> be treated in a single year (refer to the assumptions on page 42), the quantity of herbicide required to exceed the "no effect" threshold would not be applied within a timeframe to negatively affect fish and aquatic resources. Furthermore, herbicides selected for use in riparian areas or next to aquatic habitats would be restricted to those registered by the EPA for use in aquatic habitats and documented as having a low risk to fish and other aquatic species. Monitoring the effects of treatments and effectiveness of design features would further reduce the risk of unexpected impacts over the life of this project.

3. **Accidental spills.** Accidental spills are possible, but considered unlikely with standard herbicide use and handling procedures in place. If a spill were to occur, the containment plan would reduce the risk of negative effects.

Cumulative Effects to Fish and Aquatic Resources

The analysis area for cumulative effects on fisheries and aquatic resources is the San Juan, Arkansas, and Rio Grande River Basins. This boundary represents the areas where the actions proposed in this project are most likely to interact with other activities, in particular the weed treatments and ground disturbance on both national forests and other lands contained in these watersheds.

Cumulative Effects of Ground Disturbance

The potential for weed treatments to increase soil erosion and sediment transport would be minimal (as just described) and thus would not contribute cumulatively to sediment production within any watershed, especially since all the activities that cause soil erosion would be widely distributed across the forests and occur at different times throughout the year. With no cumulative increase in sediment delivery from this project, there would be no cumulative effect to aquatic insects or fish and aquatic habitat. There would be few acres following treatment largely devoid of vegetation because weeds only compose a portion of the vegetation in a treatment area. Furthermore, design features require bare ground be revegetated with native plants (table S-11, row 19).

Cumulative Effects of Herbicides

As just described, the direct and indirect negative effects from herbicides to aquatic insects or fish and aquatic habitat is low and would be of short duration (one to two days). To be cumulative, the effects from this project must overlap in space and time with the effects of other projects. Because of the short duration of treatment effects on National Forest System lands, a cumulative impact from herbicides originating on other jurisdictions is unlikely. Fish and aquatic insects are not likely to be cumulatively exposed to herbicides from multiple jurisdictions at the same time.

Furthermore, most of the jurisdictions that use herbicides are required by law to follow similar, risk-reducing measures as presented in this document. Government agencies applying herbicides must all meet acceptable levels of water quality protection.

Generally, properties bordering the forests operate small livestock and hay operations. The landowners do not typically use large amounts of herbicides, although this could increase as thistles and other weeds invade pasture lands. However, cumulatively, there would be a low risk that herbicide use by the forests and adjacent landowners would exceed the “level of no concern” thresholds proposed by the forests.

Cumulative Effects of Controlling or Eradicating Weeds

The direct and indirect effect of the action alternatives, as just described, would be to promote native vegetation, which increases native habitat that aquatic insects and fish depend on. This project would cumulatively improve stream quality along with other projects that promote native vegetation along streams. The most likely cumulative effects from all weed treatments in northern New Mexico, together with other ecosystem restoration, travel management, and road closing and decommissioning projects, would promote the occurrence of native plants and subsequent soil stability, which would reduce sedimentation and improve aquatic conditions.

Effects of Forest Plan Amendment to Fish and Aquatic Resources

Proposed amendments to the Santa Fe National Forest Plan that allow weed treatment with herbicides in currently restricted areas (municipal watersheds) and on soils with a low revegetation potential would result in no long term effects to fish and aquatic resources when future management projects are implemented using the new standard. The effects of future projects in watersheds and on soils with a low revegetation potential would be the same as those described in this section, with the resultant effect being increased native vegetation that is beneficial to aquatic species. Treatments in these areas would be subject to the design features and adaptive strategy which are designed to minimize impacts to wildlife and its habitat.

Water Resources

Affected Environment

[No changes to FEIS except as written in this section]

Watershed Characteristics

[Figure S-4 replaces figure 8]

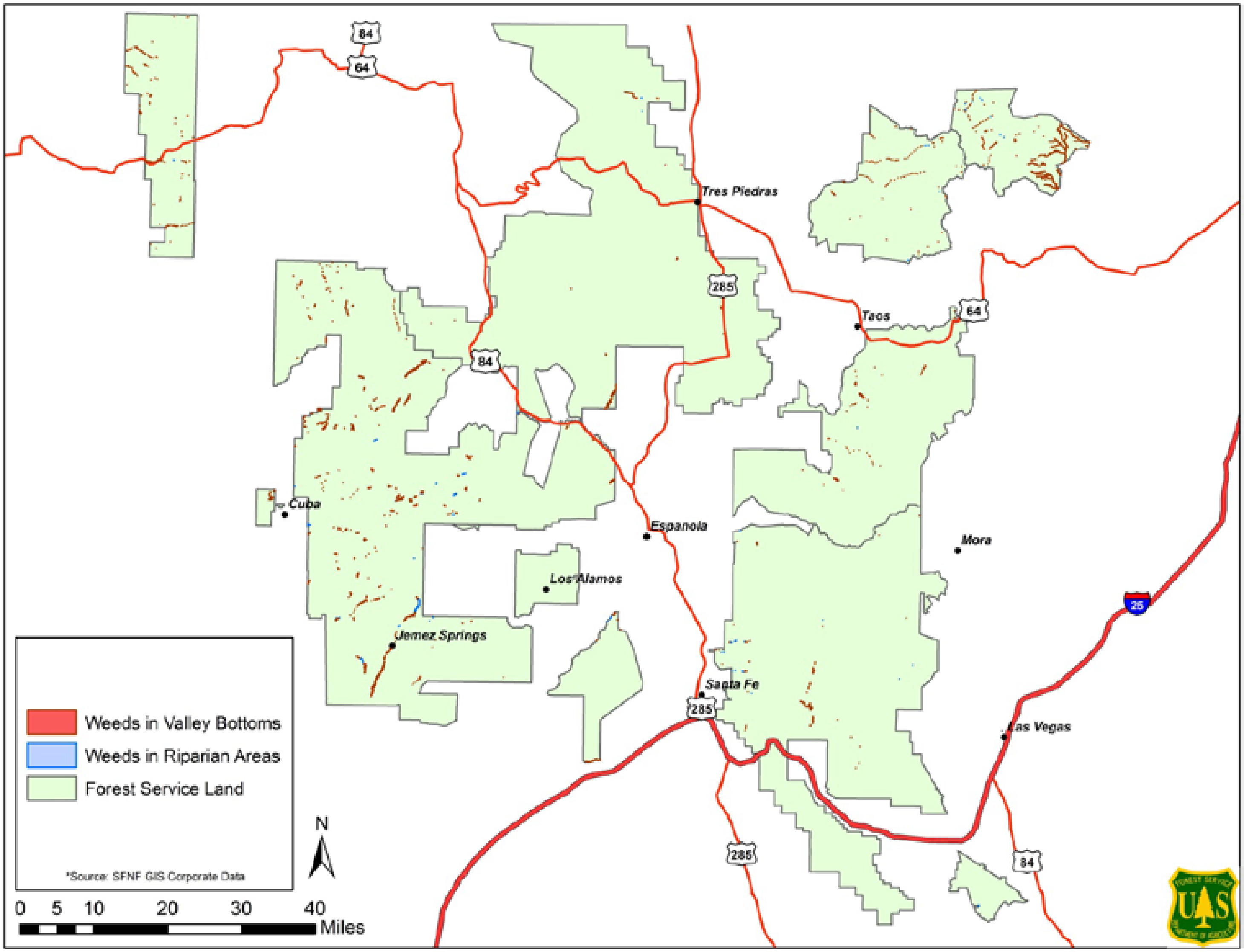

Figure S-4. Locations of weeds in valley bottoms and riparian areas on the Carson and Santa Fe National Forests

[Table S-48 replaces table 31]

Table S-48. Watersheds on or intersecting the forests and the acreage of weeds on National Forest System lands

Fourth-level Basin	Fifth-level Watershed	Total Acres	NFS Acres	Acres of Weeds
Canadian Headwaters	Headwaters Vermejo River	204,432	2,380	0
	Outlet Vermejo River	150,409	46	0
Cimarron	Ponil Creek	208,056	58,979	1,464
	Eagle Nest Lake - Cimarron Creek	213,810	1,901	<1
Mora	Upper Mora River	205,457	38,147	247
	Coyote Creek	158,845	6,882	<1
	Sapello River	187,617	27,179	3
Alamosa-Trinchera	Punche Arroyo – Rio Grande	161,508	2,362	0
Conejos	Rio de los Piños	98,967	58,003	0
	Rio San Antonio	140,335	62,657	45
Upper Rio Grande	Costilla Creek	248,591	39,874	51
	Latir Creek – Rio Grande	182,066	6,779	4
	Red River	121,273	99,927	95
	Red River – Rio Grande	144,250	6,640	1
	Rio Chama – Rio Grande	177,911	38,093	6
	Rio Grande del Rancho	94,207	83,058	180
	Embudo Creek	205,050	147,305	75
	Arroyo Aguaje de la Petaca	158,474	92,115	49
	Santa Cruz River	116, 772	69,564	71
	Pojoaque Creek	123,993	44,459	139
	Rio Pueblo de Taos	174,567	37,663	<1
	Rio Pueblo de Taos – Rio Grande	205,386	52,002	15
	Rio Tesuque – Rio Grande	128,713	24,099	2
Rio Chama	Chavez Creek	107,978	13,722	0
	Chavez Creek-Rio Chama	145,309	674	0
	El Vado Reservoir	177,883	201	0
	Rio Nutrias-Rio Chama	152,301	45,229	44
	Rio Cebolla	85,324	33,117	1
	Rio Puerco	130,217	94,768	2,090
	Arroyo Seco	103,523	82,386	0
	El Rito	86,443	68,119	401
	El Rito–Rio Chama	103,940	61,554	32
	Rio Tusas	126,520	115,725	9
	Rio Vallecitos	121,766	96,884	0
	Rio Ojo Caliente	119,698	49,013	1
	Rio Ojo Caliente-Rio Chama	88,597	53,492	99

Fourth-level Basin	Fifth-level Watershed	Total Acres	NFS Acres	Acres of Weeds
	Outlet Conejos River	166,122	568	0
	Abiquiu Reservoir	168,403	128,630	1,632
	Rio Gallina	179,293	131,378	1,711
Rio Grande-Santa Fe	Headwaters Galisteo Creek	222,374	35,934	253
	Arroyo Tonque-Rio Grande	248,839	33,824	11
	Outlet Galisteo Creek	206,318	515	2
	Santa Fe River	163,876	32,808	37
	Canada Ancha-Rio Grande	231,745	92,589	258
Jemez	Upper Jemez River	128,582	35,007	858
	Middle Jemez River	83,704	48,764	340
	Rio Guadalupe	171,203	163,627	843
	Rio Salado	158,058	2,465	0
	Lower Jemez River	123,263	1,083	0
Rio Puerco	La Canada de la Lena-Rio Puerco	112,114	5,411	22
	Arroyo San Jose-Rio Puerco	164,268	54,945	336
Pecos Headwaters	Cow Creek-Pecos River	222,190	167,941	406
	Cow Creek	81,534	61,663	255
	Tecolote Creek	181,571	41,817	78
	Tecolote Creek-Pecos River	153,500	38,792	1
	Headwaters Canon Blanco	107,249	22,700	243
	Headwaters Gallinas River	200,949	30,887	4
	Outlet Canon Blanco	165,401	20,372	0
Upper San Juan	Canon Bancos	79,497	49,700	345
	La Jara Creek	185,048	50,919	287
	Navajo Reservoir	128,049	6,386	58
	San Juan River – Navajo Reservoir	67,873	13,073	112
Blanco Canyon	Tapicito Creek	117,542	4,922	< 1
	Carrizo Creek	203,192	31,077	44
	Canada Larga	189,991	7,928	0

[Table S-49 replaces table 32]

Table S-49. Characteristics of representative watersheds

Stream Name	HUC 4 Basin Name (HUC code)	USGS Gaging Station Number	USGS Gaging Station Name	USGS Gaging Station Status	Q 20 Flow May/Sept. (cfs)
Carson National Forest					
Red River	Upper Rio Grande Basin (13020101)	08266820	Red River below Fish Hatchery, near Questa, NM	active	254/77
Rio Hondo	Upper Rio Grande Basin (13020101)	08268700	Rio Grande near Arroyo Hondo, NM	discontinued (2004)	1471/293
Rio Grande del Rancho	Upper Rio Grande Basin (13020101)	08276000	Rio Pueblo de Taos at Los Cordovas, NM	discontinued (1965)	373/23
Canjilon Creek	Rio Chama Basin (13020102)	08287000	Rio Chama below Abiquiu Dam, NM	active	106/5
Rio Tusas/Rio Vallecitos	Rio Chama Basin (13020102)	08289000	Rio Ojo Caliente at La Madera, NM	active	6613/1072
Ponil Creek	Cimarron Basin (11080002)	07207500	Ponil Creek near Cimarron, NM	active	active
Santa Fe National Forest					
Santa Cruz River	Upper Rio Grande Basin (13020101)	08291500	Santa Cruz River at Riverside, NM	discontinued (1951)	1679/554
Pojoaque River	Upper Rio Grande Basin (13020101)	08313000	Rio Grande at Otowi Bridge, NM	active	571/16
Upper Jemez River	Jemez Basin (13020202)	08321500	Jemez River below East Fork near Jemez Springs, NM	discontinued (1990)	115/24
Pecos River	Pecos Headwaters Basin (13060001)	08378500	Pecos River near Pecos, NM	active	512/96
Upper Gallinas River	Pecos Headwaters Basin (13060001)	08382000	Gallinas River near Lourdes, NM	active	24/9

There are approximately 1,713 miles of perennial streams on the two national forests.

Surface and Groundwater Quality

Surface water quality is generally good on the two national forests. Land management activities typically affect the amount of sediment and water most often. Activities that disturb vegetation or the soil surface have the greatest potential to produce sediment by increasing soil erosion. Sediment in streams and rivers varies naturally, with higher loads usually observed during spring runoff and summer storms.

Uses of water on the two national forests include coldwater fisheries, livestock and wildlife watering, recreation, domestic uses, and irrigation. Common sources of sediment to streams are livestock grazing, off-road-vehicle use, and poorly located or maintained roads (USDA Forest Service 1986a).

Several stream or river segments within and near the national forests are on the 2012-2014 State of New Mexico's Clean Water Act[8] 303(d) and 305(b) List of Impaired Waters (NMED 2012). The entire report can be found at New Mexico's Environmental Department Web site. The report lists the probable causes of impairment (such as turbidity, stream bottom deposits, or temperature) as well as the probable sources of these impairments (for example, grazing, streambank modification, or removal of riparian vegetation). The impaired waterbodies in the representative watersheds are shown in table S-50.

Table S-50. Impaired waterbodies in representative watersheds 2012-2014

Impaired Stream Name and Assessment Unit ID	Segment Length (miles)	Designated Use Not Supported	Probable Cause of Impairment	Probable Source(s) of Impairment
Carson National Forest				
Red River (Placer Creek to headwaters) NM-2120.A_710	5.63	High quality coldwater aquatic life	Nutrient/eutrophication biological indicators	Source unknown
Rio Hondo (Rio Grande to USFS boundary NM-2120.A_600	8.5	High quality coldwater aquatic life	Temperature, water	Highway/road/bridge runoff (non-construction related), rangeland grazing, streambank modifications/destabilization
Rio Grande del Rancho (Rio Pueblo de Taos to Hwy 518) NM-2120.A_501	11.5	High quality coldwater aquatic life	Nutrient/eutrophication biological indicators, specific conductance, temperature, water	Flow alterations from water diversions. habitat modification - other than hydromodification, highways, roads, bridges infrastructure (new construction), natural sources, source unknown, streambank modifications/destabilization

[8] Federal Water Pollution Control Act of 1948 as amended (i.e., Clean Water Act or CWA).

Impaired Stream Name and Assessment Unit ID	Segment Length (miles)	Designated Use Not Supported	Probable Cause of Impairment	Probable Source(s) of Impairment
Canjilon Creek (Perennial portions Abiquiu Reservoir to headwaters) NM-2116.A_030	30.63	High quality coldwater aquatic life	Nutrient/eutrophication biological indicators, specific conductance, temperature, water, turbidity	agriculture, drought-related impacts, flow alterations from water diversions, highway/road/bridge runoff (non-construction related), livestock (grazing or feeding operations), loss of riparian habitat, on-site treatment systems (septic systems and similar decentralized systems), source unknown, streambank modifications /destabilization, wildlife other than waterfowl.
Rio Nutrias (Rio Chama to headwaters) NM-2116.A_060	34.63	High quality coldwater aquatic life	Turbidity	Crop production (crop land or dry land), loss of riparian habitat, highway/road/bridge runoff (non-construction related), livestock (grazing or feeding operations), loss of riparian habitat, rangeland grazing, streambank modifications/destabilization.
Rio Tusas (Rio Vallecitos to headwaters) NM-2113.A_30	42.9	Coldwater aquatic life	Nutrient/eutrophication biological indicators	Crop production (crop land or dry land), highways, roads, bridges infrastructure (new construction), impervious surface/parking lot runoff, livestock (grazing or feeding operations), on-site treatment systems (septic systems and similar decentralized systems), rangeland grazing, wastes from pets, wildlife other than waterfowl.
Rio Vallecitos (Rio Tusas to headwaters) NM-2112.A_00	36.31	High quality coldwater aquatic life	Aluminum, temperature, water, turbidity	Channelization, highway/road/bridge runoff (non-construction related), irrigated crop production, loss of riparian habitat, natural sources, other recreation pollution sources, rangeland grazing, streambank modifications/destabilization, surface mining.
North Ponil Creek (South Ponil Creek to Seally Canyon) NM-2306.A_110	14.78	High quality coldwater aquatic life, primary contact	E. coli, nutrient/eutrophication biological indicators, temperature, water, turbidity	Forest roads (road construction and use), habitat modification - other than hydromodification, low water crossing, rangeland grazing, silviculture harvesting.
North Ponil Creek (Seally Canyon to headwaters) NM-2306.A_162	7.03	High quality coldwater aquatic life, domestic water supply	Aluminum, gross alpha - adjusted, Radium 226, Radium 228, temperature, water, turbidity	Habitat modification - other than hydromodification, low water crossing, natural sources, rangeland grazing, source unknown, watershed runoff following forest fire, wildlife other than waterfowl.

Impaired Stream Name and Assessment Unit ID	Segment Length (miles)	Designated Use Not Supported	Probable Cause of Impairment	Probable Source(s) of Impairment
Middle Ponil Creek (South Ponil to Greenwood Canyon) NM-2306.A_121	10	High quality coldwater aquatic life	Benthic macroinvertebrate bioassessments (stream), temperature, water	Loss of riparian habitat
Middle Ponil Creek (Greenwood Canyon to headwaters) NM-2306.A_124	11	High quality coldwater aquatic life	Nutrient/eutrophication biological indicators	On-site treatment systems (septic systems and similar decentralized systems), rangeland grazing, source unknown, watershed runoff following forest fire, wildlife other than waterfowl
Greenwood Canyon (Middle Ponil Creek to headwaters) NM-2306.A_22	5.24	High quality coldwater aquatic life	Aluminum	Natural sources, source unknown
McCrystal Creek (North Ponil Creek to headwaters) NM-2306.A_112	6.81	High quality coldwater aquatic life	Temperature, water, turbidity	Loss of riparian habitat, source unknown
Santa Fe National Forest				
Santa Cruz River (Santa Clara Pueblo boundary to Santa Cruz Dam) NM-2111_50	8.1	Marginal coldwater aquatic life, primary contact	E. coli, temperature, water	Source unknown
Pojoaque River (San Ildefonso boundary to Pojoaque boundary) NM-2111_20	0.6	Marginal coldwater aquatic life, warmwater aquatic life	PCBs	Source unknown
East Fork Jemez River (San Antonio Creek to VCNP boundary) NM-2106.A_13	10.39	High quality coldwater aquatic life	Aluminum, Arsenic, temperature, water	Highway/road/bridge runoff (non-construction related), natural sources, other recreational pollution sources
Redondo Creek (Sulphur Creek to VCNP boundary) NM-2106.A_25	0.73	High quality coldwater aquatic life	Turbidity	Highway/road/bridge runoff (non-construction related), loss of riparian habitat, rangeland grazing

Impaired Stream Name and Assessment Unit ID	Segment Length (miles)	Designated Use Not Supported	Probable Cause of Impairment	Probable Source(s) of Impairment
San Antonio Creek (East Fork Jemez to VCNP boundary) NM-2106.A_20	11.28	Domestic water supply, high quality coldwater aquatic life	Aluminum, Arsenic, temperature, water, turbidity	Forest roads (road construction and use), loss of riparian habitat, natural sources, other recreational pollution sources, rangeland grazing, site clearance (land development or redevelopment), streambank modifications/ destabilization
Rio Puerco de Chama (Abiquiu Reservoir to Hwy 96) NM-2115_20	8.81	Coldwater aquatic life, primary contact, warmwater aquatic Life	Aluminum, E. coli, nutrient/eutrophication biological indicators, temperature, water	Channelization, highway/road/bridge runoff (non-construction related), impervious surface/parking lot runoff, loss of riparian habitat, on-site treatment systems (septic systems and similar decentralized systems), rangeland grazing
Poleo Creek (Rio Puerco de Chama to headwaters) NM-2116.A_023	12.16	High quality coldwater aquatic life	Turbidity	Forest roads (construction and use), loss of riparian habitat, natural sources, rangeland grazing, streambank modifications/ destabilization
Rito Resumidero (Rio Puerco de Chama to headwaters) NM-2116.A_025	2.75	High quality coldwater aquatic life	Benthic macroinvertebrate bioassessments (stream)	Source unknown
Polvadera Creek (Canones Creek to headwaters) NM-2116.A_011	13.94	High quality coldwater aquatic life	Sedimentation/siltation, temperature, water	Loss of riparian habitat, natural sources, off-road vehicles, rangeland grazing
Willow Creek (Pecos River to headwaters) NM-2114.A_030	5.26	High quality coldwater aquatic life	Sedimentation/siltation, specific conductance	Source unknown

On December 15, 2010, the New Mexico Water Quality Control Commission issued an Order and Statement of Reasons (effective January 14, 2011) designating Outstanding National Resource Waters. This designation applies to all streams and their tributaries and wetlands originating in wilderness areas administered by the U.S. Forest Service in the State of New Mexico. A list and maps of designated stream segments and wetlands can be found at the New Mexico Environment Department Web site.

Groundwater on the two national forests is widely variable and often associated with riparian areas and wetlands. Depths to groundwater can vary from shallow to several hundred feet or more depending on topography and geology. Typically, the mountainous terrain in the two national forests provides areas of groundwater recharge. Shallow groundwater resources, such as those associated with wetlands and places adjacent to streams and riparian areas, are stored in saturated soils and deeper sediments and supplement surface waterbodies through discharge of groundwater during periods of low flow. Other groundwater resources, such as springs and seeps are important sources of water for wildlife and habitat for groundwater-dependent species. Sources of potential contamination of groundwater are varied, but commonly include fuels, oils, solvents, paints, and detergents, and the generation of solid and liquid wastes. Typical sources of contamination on National Forest System lands include mines, oil and gas wells, landfills, and septic systems and associated leachfields.

Drinking water wells in the two national forests range in depth from 55 feet to 150 feet or more. Yield of groundwater from these formations usually is low (less than 25 gallons per minute) (USDA Forest Service 1986a). In contrast, most valley bottoms have shallow groundwater in alluvial deposits. This groundwater is most likely closest to ground surface in May and June, declining through the summer as streams approach low flow conditions.

Groundwater quality on the forests is variable, but generally thought to be high due to the remoteness of the resource to large sources of contamination, such as those described above. Groundwater quality near areas of urban development, mining activities, and oil and gas development is most likely to demonstrate a lower quality than areas far removed from these potential sources of contamination.

Analysis Methods

[No change from FEIS]

Environmental Consequences to Water Resources

[Additional summary section]

Summary of Effects to Surface Water Quality

For any action alternative, a slight increase in sedimentation following treatment is expected when compared to alternative A. An increase in sedimentation means that surface water quality could decrease (e.g., more turbidity). The no-action alternative would keep sedimentation at background levels initially, but as invasive species continue to spread in extent and displace native vegetation, water quality could be expected to decline. Because the no-action alternative does not propose any weed treatments, no changes in vegetation, ground cover, or plant composition would occur. In the first 1 to 3 years, alternative C would probably produce the most sediment of the action alternatives because without the option of herbicides, most treatments would be ground-disturbing and would need to be repeated to control invasive species populations. After 3 years, the restoration of native plant communities and the revegetation of bare soil caused by these ground-disturbing treatments is likely to reduce the amount of sediment produced with an overall improvement to surface water quality.

Summary of Effects to Groundwater Quality

For any action alternative, a slight risk of effect to groundwater quality exists, but this risk correlates to the amount of herbicide use when compared to alternative A. An increase in acres treated by herbicide application poses a slight risk of groundwater effects from application near shallow groundwater tables (riparian areas and wetlands) or accidental spills of herbicide. The no-action alternative would eliminate this risk as no weed treatments of any kind would occur. Compared to the other action alternatives, alternative C would also minimize or eliminate the potential for groundwater impacts because without the option of herbicides, most treatments would be mechanical or cultural in nature. Alternative B, which does allow herbicide use along with other specified treatment methods, may pose a slight risk of groundwater impacts, but design features would control and reduce this potential risk to groundwater resources.

Summary of Effects to Outstanding National Resource Waters from All Alternatives

The designation of a waterbody as an Outstanding National Resource Water (ONRW) comes with an antidegradation policy (20.6.4.8 NMAC). The antidegradation policy requires that "water quality be maintained and protected in ONRWs" and the policy is interpreted to mean "no new or increased discharges to ONRWs and tributaries to ONRWs would result in lower water quality in the ONRW." The policy states "temporary and short-term degradation resulting from nonpoint source discharges shall last no longer than the activity that causes the degradation and shall in no event last longer than six months."

Under the no-action alternative, there would be no effects from this project to ONRW because no weed treatments would take place. There would be no nonpoint discharges from weed control projects.

Under all action alternatives, the risk of impacts to surface waterbodies and wetlands designated as ONRW is low and would comply with the requirements of the antidegradation policy, meaning that impacts would be temporary and short term. With the design features requiring not using certain herbicides near water and of revegetating denuded areas, no new or increased discharges to ONRW and tributaries are expected. Because the effects of herbicides last only several days, the expected effect to ONRWs from herbicide treatment would comply with the timeframe (less than 6 months) outlined in the antidegradation policy. Vegetation in riparian areas tends to grow back within a season, eliminating the risk of an increased discharge to an ONRW stream. Finally, the location of the current weed populations in wilderness areas is such that the effects of any treatments are unlikely to reach streams.

Alternative A

[No change from FEIS]

Alternatives B and D

[No change from FEIS]

Alternative C

[No change from FEIS]

Cumulative Effects to Water Resources

Under the no-action alternative, there would be no direct or indirect effects from weed treatments; therefore, there would be no cumulative effects to surface water quality, groundwater quality, or ONRWs. The effect of not treating weeds is that weeds would continue to spread. This would increase the loss of desirable plant species and biological diversity, which in turn would likely cause increased surface water runoff, soil erosion, and sedimentation in watersheds with weeds, and in the long term, watersheds that are currently not affected by invasive species populations. Without some type of control of current populations, it is likely that invasive populations will expand via pathways (such as roads and trails) used by forest personnel and visitors. New populations are likely to establish and expand via other means such, as seed dispersal by wildlife and cattle. It is plausible that by 2025, extensive herbicide treatment, such as by aerial application, could be required to gain control of weed populations that are rapidly spreading and increasing in size. Aerial applications of herbicides would certainly cause effects to surface water quality.

The direct and indirect effects to surface water quality from the action alternatives are likely to be a minor increase in soil erosion and subsequent sediment transport to surface waterbodies from ground disturbances during project implementation. Nearly all other ongoing and foreseeable future activities on the two national forests listed in the beginning of this chapter would continue to contribute to erosion and sediment, including vegetation and fuel management projects; road maintenance, reconstruction, closing, and decommissioning; prescribed burning and wildland fires, livestock grazing, and all recreational uses. The amount of sedimentation caused by weed treatments is expected to be so minor as to be immeasurable; thus, when added to other cumulative actions, none of the action alternatives is expected to contribute cumulatively to sedimentation enough to change surface water quality (e.g., cause a listing of impaired waters). Herbicide use by adjacent landowners and agencies would cumulatively result in minor and short-term herbicide loading to the environment. Those additional acres would cumulatively add a small amount, but would be unlikely to exceed EPA standards.

The direct and indirect effect to groundwater quality from the action alternatives is minor to immeasurable. Other than effects of accidental spills of herbicide, the effects to groundwater from treatment of invasive species through mechanical or other cultural practices are unlikely. Herbicide use by adjacent landowners and agencies may cumulatively result in minor and short-term herbicide loading to groundwater resources, but design features and design features for the Forest Service's use of herbicides would control and reduce this potential risk to groundwater resources. Those additional effects could cumulatively result in a perceptible effect, but would be unlikely to exceed EPA standards.

No measurable direct or indirect effects from the action alternatives to Outstanding National Resource Waters would occur; therefore, there would be no cumulative effects.

Implementation of any action alternative would combine with other stream and watershed restoration activities that could move nonattainment streams toward attainment status.

Effects of Forest Plan Amendment to Surface and Groundwater Quality

The proposed amendment would help achieve desired conditions described in the forest plan for soil, water, and riparian conditions that would otherwise be threatened by the continued spread of weeds. Allowing herbicide applications within municipal watersheds, on national forest land adjacent to homes, and on soils within certain tolerances expands the opportunity to control weeds in the future. Because the amendment includes a mitigation measure that requires sufficient ground cover to ensure that soil erosion does not exceed the tolerance level for that soil type based on the Terrestrial Ecosystem Survey for the Santa Fe National Forest (USDA Forest Service 1993), long-term soil productivity would be maintained in all future projects where herbicides would be applied.

The proposed forest plan amendment would allow the use of herbicides in the Santa Fe and Gallinas municipal watershed provided Santa Fe and Las Vegas city officials concur with the proposed treatment prescription and design features to be implemented. This stipulation could increase or decrease the amount of herbicide applications allowed in the future, depending on the personnel making decisions at the time. Allowing herbicides, as described throughout this chapter, is expected to increase the presence of native vegetation and thus is likely to improve water quality. Not allowing the use of herbicides is expected to have the opposite effect in this and future projects.

Other entities, including environmental organizations, have applied herbicides in the lower portions of these watersheds outside the national forest boundary. Allowing the use of herbicides in the watersheds would render treatments adjacent to the Santa Fe National Forest more effective in the future because weeds would be less likely to spread from the portion of the watershed on forest land to the lower watershed sections. Permitting the use of herbicides would improve the effectiveness of eradicating or controlling the spread of saltcedar, Siberian elm, Russian olive and other weed species in the municipal watersheds and would contribute to improving water quality in the long term, and possibly even water quantity because of these species high water use.

Soil

[Replaces entire section; figure S-5 replaces figure 10 and figure S-6 replaces figure 11]

Methodology

A review of scientific literature provided the basis for the effects to soils from the use of herbicides.

Affected Environment

Soil landscapes on the Carson and Santa Fe National Forests can be subdivided into three provinces with distinct soil assemblages: Colorado Plateau Semi-Desert, Southern Rocky Mountain Steppe, and Southwest Plateau Provinces (Bailey 1995). The Rocky Mountain Steppe assemblage dominates the north-central region of New Mexico, the Colorado Plateau dominates the southern and western areas, and the Southwest Plateau occurs primarily in the Pecos-Canadian Plains and Valleys in the eastern part of the State. Specific soils associated with each assemblage on the forests are described in detail in the specialist’s report.

How Weeds Can Affect Soil

Weed infestations affect soil quality by outcompeting native species for water and nutrients (Olson 1999a). Broadleaf weeds often produce deeper taproot systems and less canopy cover compared to the native species that they displace (DiTomaso 1999). Due to these physiologic and morphologic differences, weed infestations can cause negative changes in overall soil quality. The weed species that occur on the two national forests, where dense, are assumed to be causing these effects.

Organic matter may be reduced or redistributed in weed-infested soil. Weeds may decay more slowly than native species (Olson 1999a; Olson and Kelsey 1997). Slower decay rates result in less annual input of organic matter to the soil. Since weeds also tend to have deeper roots and less foliage than native species, decay of these plants will contribute less litter and organic matter near the soil surface.

Infiltration can be reduced on weed infested sites due to reduced cover (DiTomaso 1999; Olson 1999a). Lacey et al. (1989) measured significantly greater surface water runoff, indicating less infiltration, from spotted knapweed dominated sites compared to adjacent native grass dominated sites. Decreased soil organic matter can reduce the amount of water held in the soil, especially near the surface (Brady and Weil 1999; Tisdall and Oades 1982).

Reduced cover - On weed infested sites, reduced vegetative cover can result in higher evaporation from the exposed soil surface (Lauenroth et al. 1994, Olson 1999a). On sites where weeds are dense, the high transpiration rate may deplete water stored deeper in the soil (Olson 1999a).

Erodibility - Weed infested soil has been shown to be more erodible than soil supporting native grass species (Lacey et al. 1989). With less cover than native species, weeds are less able to dissipate the kinetic energy of rainfall, overland flow, and wind that cause erosion (Torri and Borselli 2000; Fryrear 2000).

Biota - Since abundance of soil microbial biomass is generally related to the organic matter content of soils (Brady and Weil 1999), it is possible that weed infested soils may support smaller populations of microorganisms than noninfested soils. Considering the deeper root distribution and reduced litter production of weeds compared to native grasses, it is possible that weeds could result in a change of size or distribution of soil microbial populations.

Weeds directly limit nutrient availability through their ability to out-compete native species for limited resources. Weeds have high nutrient uptake rates and can deplete soil nutrients to very low levels (Olson 1999a). Potassium, nitrogen, and phosphorous levels were 44 percent, 62 percent, and 88 percent lower in spotted knapweed infested soil than in adjacent grass covered soil (Olson 1999a). In addition, some weed species germinate prior to native species and take up nutrients and water before native species are actively growing (Olson 1999a). In instances where weed decomposition occurs slowly, nutrients remain immobilized in the plant tissue and are unavailable for uptake by other species. Weeds indirectly limit nutrient availability due to increased soil erosion that can occur in infested areas. Erosion selectively removes organic matter and the finer sized soil particles that store nutrients for plant use, leaving behind soil with a reduced capacity to supply nutrients (Brady and Weil 1999).

The Forest Service, through surveys, has characterized the properties of soils on the two national forests. These are described in the 1993 Terrestrial Ecosystem Surveys. Two interpretations, erosion hazard and revegetation potential, are pertinent to this project. The erosion hazard (figure S-5) describes the susceptibility of the soil to erosion upon removal of vegetation and litter. Revegetation potential (figure S-6) refers to the probable success and ease of native grass establishment. Revegetation potential is influenced by climate, soil characteristics and slope. The following tables show the how much of the project area is in each category.

Table S-51. Weed acres by erosion hazard class

Erosion Hazard Class	Total Acres	Acres of Weeds	Percent
Interpretation not available	645,091	1,134	0.2
Slight	536,798	1,568	0.3
Moderate	2,427,040	6,218	0.3
Severe	1,613,463	4,329	0.3

Table S-52. Weed acres by revegetation potential class

Revegetation Potential Class	Total Acres	Acres of Weeds	Percent
Interpretation not available	18,199	6	0.03
High	2,506,454	4,900	0.2
Moderate	1,254,155	4,967	0.4
Low	1,443,585	3,376	0.2

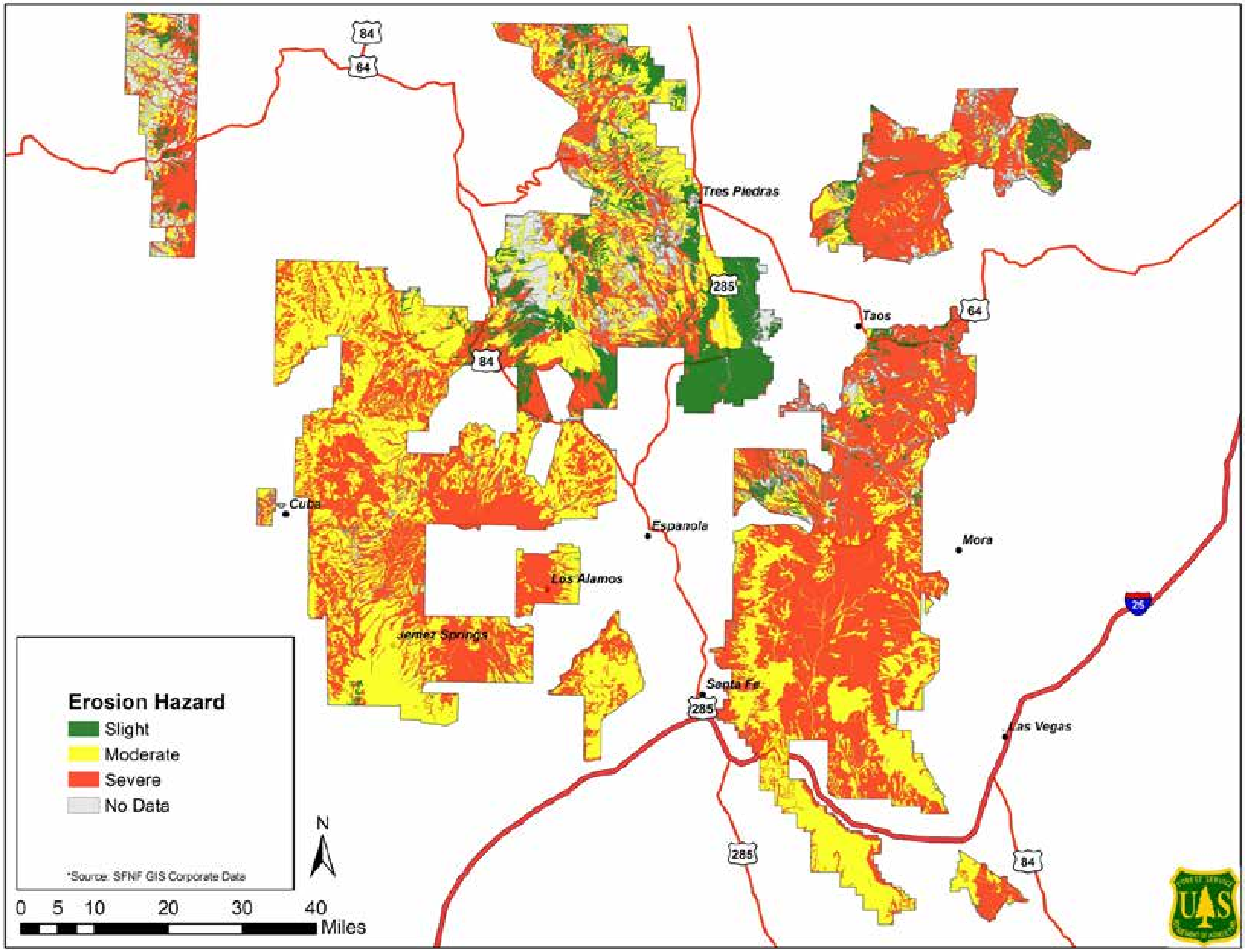

Figure S-5. Areas of slight, moderate, and severe erosion hazard on the Carson and Santa Fe National Forests

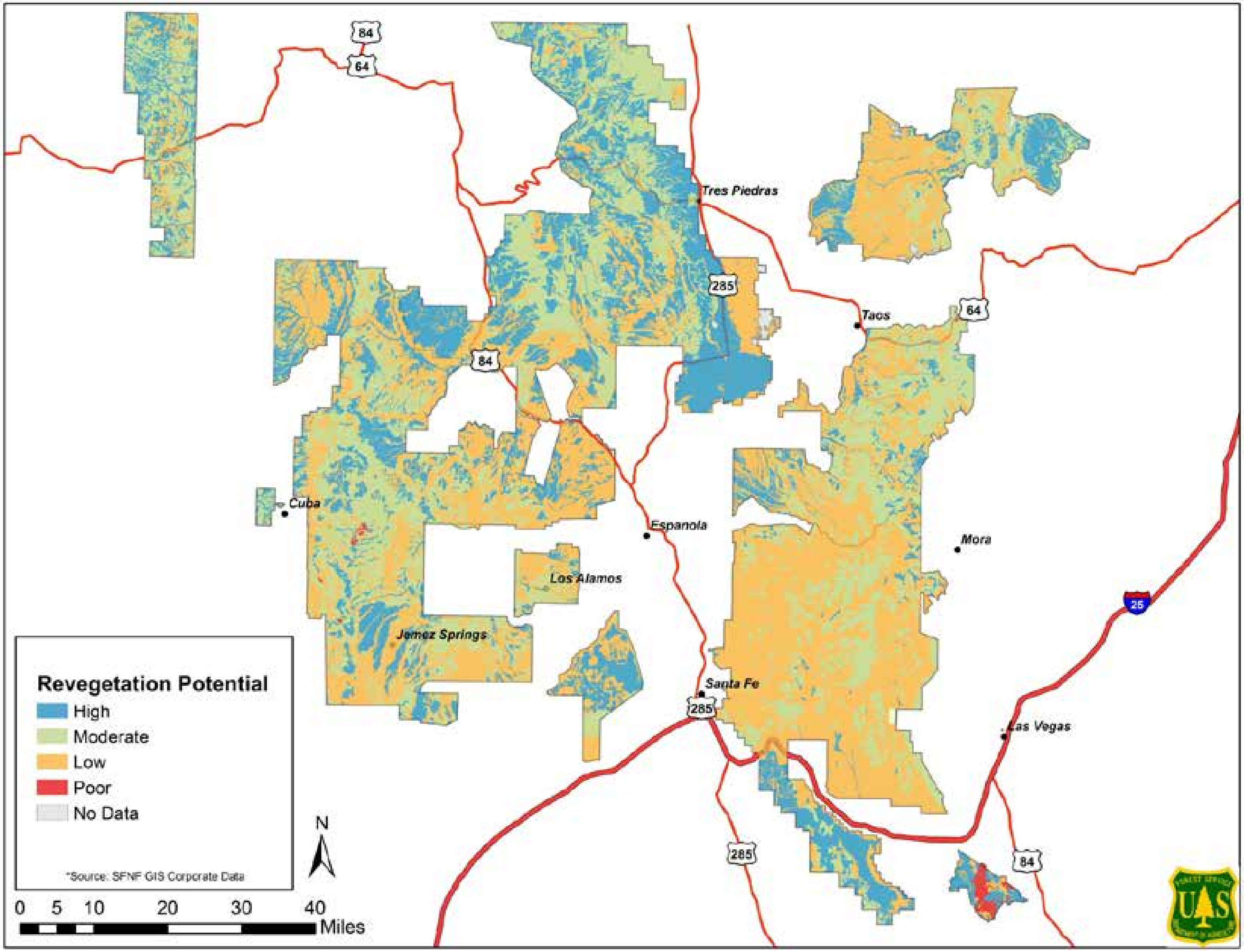

Figure S-6. Areas of revegetation potential (ranging from poor to high) on the Carson and Santa Fe National Forests

Environmental Consequences to Soil

Alternative A - No Action

Without action, weeds would continue to spread at the assumed average rate of 8 percent per year. Dense weed infestations are likely to result in the negative impacts just described in the "Affected Environment" section. Erosion may increase and revegetation potential decrease at the specific locations where weeds exist and at other yet to be determined locations.

Effects of the Action Alternatives Treatment Methods on Soil

In summary, soil disturbance from this proposal would not be considered detrimental when considered with the beneficial, long-term improvements in soil quality and productivity in areas where weeds are treated and native vegetative is reestablished. For all methods, the size and extent of soil disturbance would be limited to the area treated, which is a small percentage of the project area overall (0.05 percent, based on an average of 1,500 acres treated per year). The duration of the effect would be limited to the recovery period, which typically ranges from a few months to a year. The design features in chapter 2 (table S-11, row 19) and the proposed plan amendment ensure that erosion rates would not exceed tolerance levels established in the forest plans. Finally, most of the known weed populations are near roads, campsites, trails, and other locations that already have an existing level of soil disturbance. Overall, any treatment method would improve soil quality by controlling weeds and minimizing the negative effects of weeds described in the "Affected Environment."

The following paragraphs describe the effects the methods proposed are expected to have on soils.

Mechanical methods, where heavy equipment removes or plows up weeds, are the actions most likely to leave bare soil or cause soil compaction following treatments. The design features that prohibit the use of heavy equipment such as mowers or mechanized diggers on slopes over 40 percent would reduce the potential for erosion. All the methods that do not use herbicides are likely to require follow-up treatments, resulting in the potential for more ground disturbance than would occur from the use of herbicides.

Manual methods, such as incidental hand pulling and grubbing of weeds, would result in minor soil disturbance where weeds are pulled. The size of the disturbed area would be negligible when considered against the size of the project area. Any disturbed soil would be outweighed by the benefit of removing the weeds.

High-intensity, short-duration grazing can cause soil compaction that is proportional to the intensity and duration of grazing. The degree of compaction is not expected to reduce soil productivity because monitoring would control the amount of time herbivores would remain on a site.

Prescribed fire would result in little bare soil. Its use is governed by strict parameters designed to keep litter, duff, and some vegetation in place.

Biological methods, for example the release of insects, are expected to result in no ground disturbance because the biological agents attack the plant and leave the soil intact. These herbivorous insects have a high degree of host specificity and would not be expected to target beneficial, native vegetation. Biological control agents would provide the benefit of weed control without the potential for changes to soil biota communities.

Herbicides are expected to have effects on soils for a year or less in the areas treated. Of the methods proposed, herbicides have the most potential to affect the quality of the soils, but the science is inconclusive. Some research indicates that herbicides can decrease the diversity and relative biomass of individual species of soil microorganisms (Forlani et al. 1995, Ka et al. 1995, SERA 2003a). It is likely that a temporary shift in the soil microbial community would occur immediately following herbicide applications. Microorganisms that are resistant to the herbicide or adapted to use it as an energy source would gain a competitive advantage over nonadapted microorganisms.

Other researchers, however, found that herbicides had no effect on soil bacteria, nematodes, or collembola beyond what was expected from the associated reduction in ground cover (Wardle et al. 2001). The complex interactions between soil biota, environment, and herbicide type make predictions of impacts on soil biota difficult.

While herbicide exposure can influence the diversity of soil microorganisms, the reported data indicate that this influence is transient as long as adequate time is allowed for the soil community to rebound between exposures. Brady and Weil (1999) report that negative effects of most pesticides on soil microorganisms are temporary and populations generally recover after a few days or weeks.

Certain herbicides, such as glyphosate and dicamba, have been observed to cause weight reductions or mortality in earthworms. Surviving earthworms would be expected to recover, but the population may be decreased after each herbicide application. Soils with reduced earthworm populations would exhibit reduced water infiltration, nutrient cycling, and fewer stable soil aggregates compared to similar soils with greater earthworm populations (Brady and Weil 1999). In areas where earthworms are susceptible to the type of herbicide applied, the population may remain suppressed until application ceases. A study of the effects of herbicides on soil arthropods found that no significant change in the arthropod population occurred due to herbicide exposure (Fuhlendorf et al. 2001).

Table S-53 shows the characteristics of the herbicides as they pertain to their behavior in soil. The half-life is how long a given amount of an herbicide would be reduced by half; it measures how long an herbicide is expected to remain present in the soil.

Alternative B – Proposed Action

Alternative B proposes the full suite of treatments, so all the effects described above are anticipated to occur. The maximum annual acreage expected to be treated in the project area is 6,000 acres (0.2 percent of the project area), with the acres widely distributed in space and treated at different times. As a result, the magnitude and intensity of any effect would be negligible.

For up to a year following treatments, erosion may increase and revegetation potential decrease at the specific locations where weeds are treated. These negative impacts would be offset by the long-term, beneficial effects of reestablishing native vegetation.

Table S-53. Characteristics of herbicides in soil

Herbicide	Solubility (ppm)	Potential For Mobility	Half Life (Days)
Aminopyralid	212 (pH 5) 205 (pH 7)	High	5 to 343 depending on soil type
Chlorsulfuron	300 (pH 5) 7,000 (pH 7)	High (increases with pH)	30 to 120
Clopyralid methyl	1,000	High	15 to 287
Dicamba	4,500	High	7 to 42
Glyphosate	12,000 to 900,000	Low	3 days - several years
Hexazinone	33,000	High in soil, low in leaf litter	30 to 180
Imazapic	2,200	Moderate (increases with pH)	31 to 233
Imazapyr	11,272	Moderate to high	Several months
Metsulfuron methyl	1,750 (pH 5.4) 9,500 (pH 7)	High (increases with pH)	14 to 80
Picloram	430	High (increases with pH)	20 to 300
Sulfometuron methyl	0 (pH 5) 300 (pH 7)	Low (increases with pH)	30
2,4-D	890 to 800,000	High	30 or less
Triclopyr	23 to 2,100,000	Moderate	30 to 46

Alternative C - No Herbicides

Because alternative C is not expected to be as successful at controlling weeds across the forests as quickly as the other action alternatives, weed populations would continue to spread and impact soils. In those areas, adverse effects on soil properties and soil quality would be similar to that described under alternative A, but on fewer acres.

Without the option of herbicides, alternative C would require more digging, mowing, prescribed burning, grazing and other nonherbicide treatment methods. It would also require more follow-up treatments to effectively control weeds on the same sites. This means the opportunity for soil disturbance and subsequent soil erosion would be greater than in the other action alternatives, but is still considered negligible when considered in the context of the entire project area. Follow-up treatments would extend the duration that soils are vulnerable to erosion, and repeated treatments over time would likely maintain the vulnerability of these sites to weed infestations, thus lowering soil productivity. This alternative eliminates the impacts from herbicides on the microbial community and earthworm populations.

For up to a year following treatments, or possibly longer, erosion may increase and revegetation potential decrease at the specific locations where weeds are treated. These negative impacts would be only partially offset by the long-term, beneficial effects of reestablishing native vegetation.

Alternative D - Only Herbicides

Alternative D eliminates the negligible potential for erosion and compaction that would be caused by all the methods except herbicides. Since the acreage would only be treated with herbicides, all the soils would be subjected to the effects of herbicides described above.

For up to a year following treatments, erosion may increase and revegetation potential decrease at the specific locations where weeds are treated. These negative impacts would be offset by the long-term, beneficial effects of reestablishing native vegetation.

Cumulative Effects to Soil

Alternative A - No Action

Activities occurring on the forests that contribute to the introduction and spread of invasive weeds would add cumulatively to the impacts of alternative A. Failure to act to control weeds would add to the reduced soil quality that are caused by weeds and other activities that introduce and spread invasive weeds. Soil quality would degrade in proportion to the increase in weed spread. For several years, these additive effects would not cause a large-scale loss of soil productivity; however, over time as weed infestations continue to spread and become more dominant on the forests, loss of soil productivity would become evident.

All Action Alternatives

All activities and land uses on the forests contribute to soil disturbance and some degree of erosion; most serve as vectors with the potential to introduce and spread invasive weeds. The action alternatives initially would cumulatively add minor, short-term increases in erosion for a season or less. However, management activities under the control of the Forest Service would include measures to avoid rates of erosion that exceed forest plan standards and to maintain soil productivity. Therefore, the effects of weed treatments cumulative with other activities occurring on the forests are expected to be negligible.

In addition, most ongoing and foreseeable future activities have objectives aimed at enhancing and restoring ecosystem functionality and healthy water and soil conditions. Many recent projects have successfully improved soil productivity. These projects include closing and decommissioning forest roads, reducing camping and grazing in riparian areas, and reducing where motorized use may occur throughout the forests. These actions would have cumulatively beneficial effects and would combine with the long-term beneficial effects of the proposed weed treatment project to reduce soil erosion and sedimentation.

Cumulative impacts to soil quality also would occur from the herbicide loading in alternatives B and D when added to other public agencies and private landowners in the area conducting similar herbicide treatments. Cumulative effects would also occur to soil organisms from herbicide applications; however, these impacts are expected to be temporary and limited in extent to the treatment sites. Cumulatively, treatments would not affect soil organisms located away from treatments (on forest or off). Beneficial cumulative effects would occur in treated areas as native vegetation becomes reestablished and over the long-term soil qualities improve.

Effects of Forest Plan Amendment to Soil

The proposed Santa Fe National Forest Plan amendment would modify the soil resource standards and guidelines. It would allow the forest to use herbicides on soils with a low revegetation potential. Not using herbicides on these soils would be counterproductive to meeting the purpose and need, and soils would be adequately protected by applying the adaptive strategy (table S-10) and design features (table S-11) listed. With the design features and adaptive strategy applied to this and all future projects, no negative impacts to soil productivity or characteristics would be expected to last longer than 6 months. (Herbicides such as picloram, which last longer in soil and are more mobile, would not be used near water by design; see chapter 2.) By controlling or eradicating weeds in this and future projects, an overall beneficial impact to soils is predicted; restoring native vegetation on soils generally reduces erosion, thereby increasing productivity. The design features and adaptive strategy listed in table S-10 and table S-11 replace the cation exchange standard and provide more protection to soils. Thus, deleting this standard from the forest plan would not be expected to reduce soil productivity or change soil characteristics in this or future projects that apply herbicides to certain soils. There would be no impact to soil resources and erosion rates would not exceed the tolerance level identified in the Terrestrial Ecosystem Survey for the affected soil unit.

Air Quality

[Replaces entire section]

Affected Environment

Introduction

The project area contains both the Carson and Santa Fe National Forests, and is located within four major airsheds as defined by the New Mexico Environment Department. Those four airsheds are the Upper Rio Grande, the Middle Rio Grande, the Canadian River and the Pecos airsheds (NMED 2003). All airsheds in New Mexico are based on watershed boundaries developed by the New Mexico Water Quality Control Commission. These airsheds cover many counties; however, the project area lies mainly within the following counties: Rio Arriba, Taos, Colfax, Sandoval, Los Alamos, Santa Fe, Mora, and San Miguel Counties. The project area includes significant population centers along the Rio Grande, including Santa Fe, Taos, Los Alamos, and Espanola, including many pueblos and small communities.

There are four class 1 areas within the project area: Wheeler Peak, San Pedro Parks and the Pecos Wilderness, which are all managed by the Forest Service; and Bandelier National Monument, which is managed by the National Park Service. Class 1 areas are identified in the Clean Air Act as areas that require the highest level of protection for air quality related values, such as visibility, in addition to the national ambient air quality standards (NAAQS).

Southwesterly winds typically blow across the mountainous region of northern New Mexico. Temperatures vary from an average daily maximum of 86 °F in July in Jemez Springs to an average daily minimum of 3 °F in Dulce in January (data from Western Regional Climate Center).

Emissions

Emissions affecting air quality can come from a variety of sources. Emissions are typically associated with either point sources, such as large industrial facilities or power generation, or area sources, such as emissions from vehicles or fugitive dust from agriculture. Emissions and dust from as far away as California and Asia or as nearby as the Four Corners region can contribute to reductions in visibility, deposition of pollutants, and impacts to ambient air quality. For the purpose of this assessment, only emissions from the counties that contain the project area and some of the surrounding counties were considered because potential effects of herbicide drift and smoke affecting air quality is not likely to go farther than the area described.

There are many offsite sources (facilities) capable of impacting air quality in the project area, such as: power plants, oil and gas operations on the west side of the forests and Four Corners area, natural gas compressor stations and refineries in the San Juan Basin, mining operations in Taos, Santa Fe, and Rio Arriba Counties, biomass plants and other sources such as foundries and landfills (EPA National Emissions Inventory).

Regulatory Environment

There are two primary regulatory considerations under the Clean Air Act for actions by the Forest Service: the national ambient air quality standards (NAAQS) and the regional haze program. NAAQS include primary standards to protect public health, and secondary standards that protect the environment. The aim of NAAQS is to set standards for the concentration of certain pollutants in the ambient air so they are below levels that would impact public health or the environment. The regional haze program requires states or the Federal Government to develop plans that reduce emissions from all sources across a state, so that visibility returns to natural conditions without the impact of human-caused sources by 2064.

National Ambient Air Quality Standards

New Mexico and the Federal Government have established air quality standards for specific criteria air pollutants. The criteria pollutants are carbon monoxide (CO), lead (Pb), sulfur dioxide (SO_2), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), ozone (O_3), and nitrogen dioxide (NO_2). Of those seven criteria pollutants, the pollutants of concern for this project are the particulate matter pollutants $PM_{2.5}$ and PM_{10} from prescribed fire.

Air quality in the project area is classified as being "in attainment" for all criteria pollutants. A "nonattainment" designation means that violations of standards have been documented in the region. There are no nonattainment areas within the project area. Typically, all areas within the project area have very good air quality, with measured values that fall below all Federal and State standards.

[table S-54 replaces table 41]

Table S-54. National and New Mexico ambient air quality standards for criteria pollutants of concern

Pollutant	Averaging Time	New Mexico Standards	National Standards[a] Primary[b]	National Standards[a] Secondary[c]
PM_{10}	24-hour	Same as national standards	150 µg/m^3	Same as primary
$PM_{2.5}$	Annual (arithmetic mean)		12 µg/m^3	
	24-hour		35 µg/m^3	

a. Concentrations are expressed in units in which they were promulgated. µg/m3 = micrograms per cubic meter. Units shown as µg/m3 are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury.

b. Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

c. Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

Figure S-7 through figure S-9 summarize the range of $PM_{2.5}$ and PM_{10} pollutants found in or near the project area from the State's air quality monitoring data from 2010 through 2012. For both $PM_{2.5}$ and PM_{10}, the measured values in Santa Fe and Taos are significantly below the standards. Both represent monitored values much closer to a variety of urban emission sources (primarily vehicles) and it is assumed that values on the forest are typically less than what is measured at either of these monitoring sites.

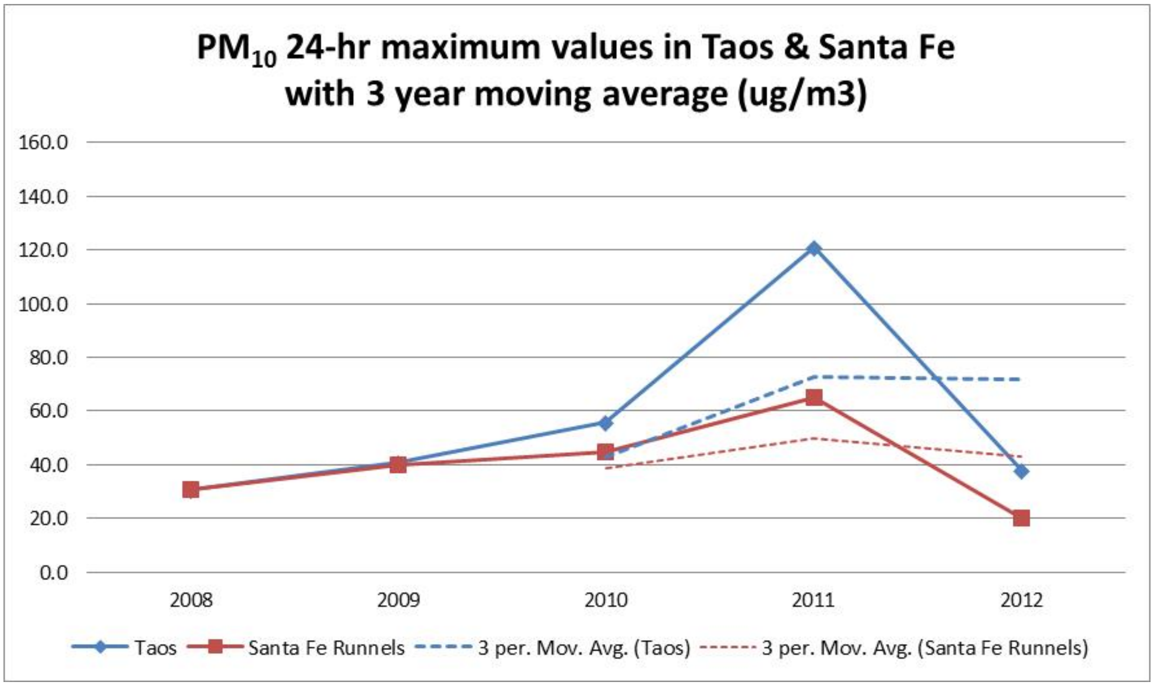

Figure S-7. PM_{10} 24-hr maximum values in Taos and Santa Fe with 3-year moving average (ug/m^3)

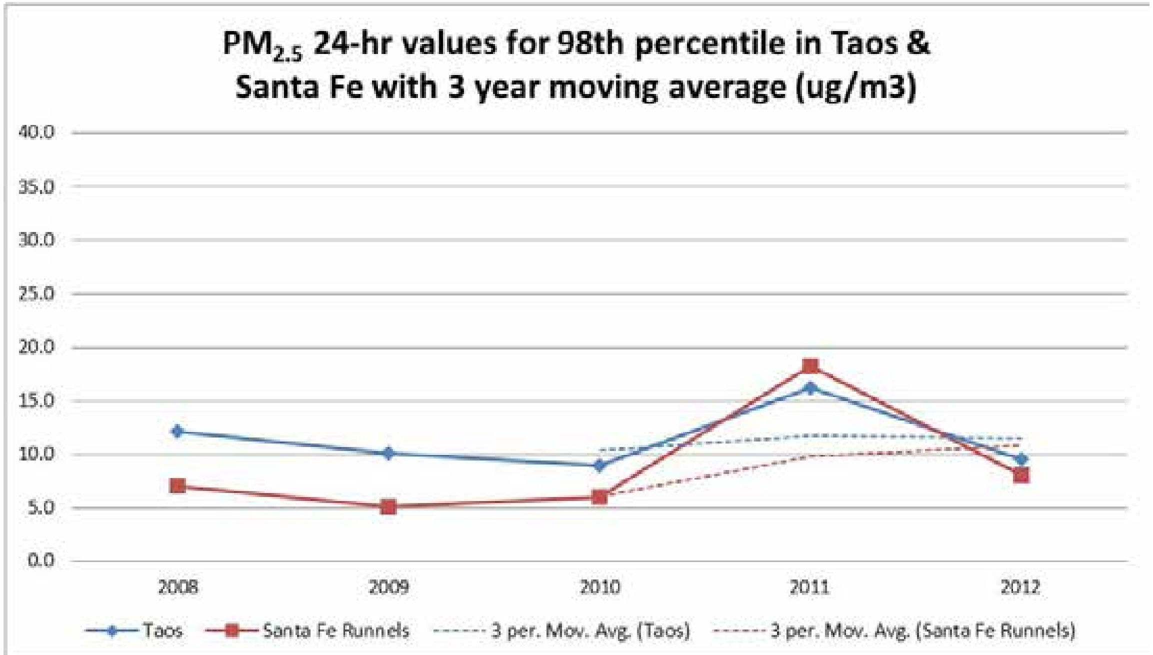

Figure S-8. $PM_{2.5}$ 24-hr values for 98th percentile weather conditions in Taos and Santa Fe with 3-year moving average (ug/m^3)

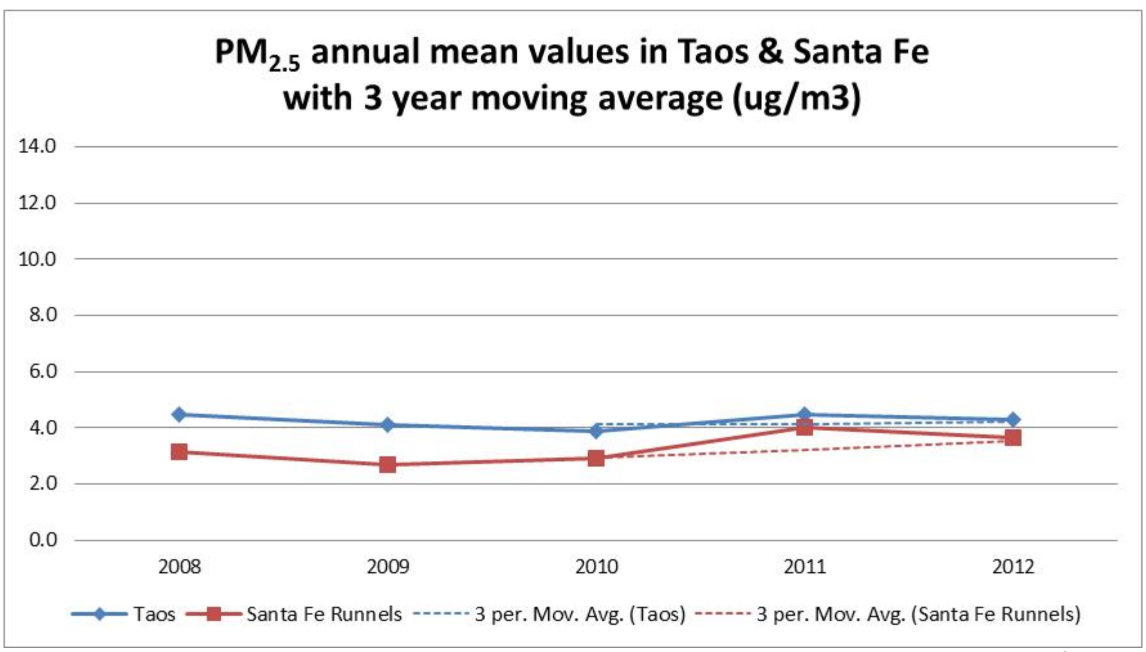

Figure S-9. $PM_{2.5}$ annual mean values in Taos and Santa Fe with 3-year moving average (ug/m^3)

Regional Haze – Visibility

Visibility is the condition that allows people to see and appreciate the inherent beauty of the landscape features. It can be greatly impacted by particulate matter and gasses that are in smoke or dust (Malm 2000). Visibility and other air quality standards are most stringent within designated class 1 areas. Thus, most monitoring for visibility is conducted in class 1 areas, which for this project are San Pedro Parks Wilderness and Bandelier National Monument. The results of this monitoring and projections for visibility in the future are shown in the next two figures.

The Regional Haze Rule sets a goal to return class 1 areas to natural visibility conditions by 2064. As of 2010, both class 1 areas were slightly ahead of schedule, but further improvements will be needed to meet the national visibility goal. In 2011, visibility was impacted at both monitoring locations as a result of smoke from the Las Conchas and Wallow Fires (figure S-10 and figure S-11.

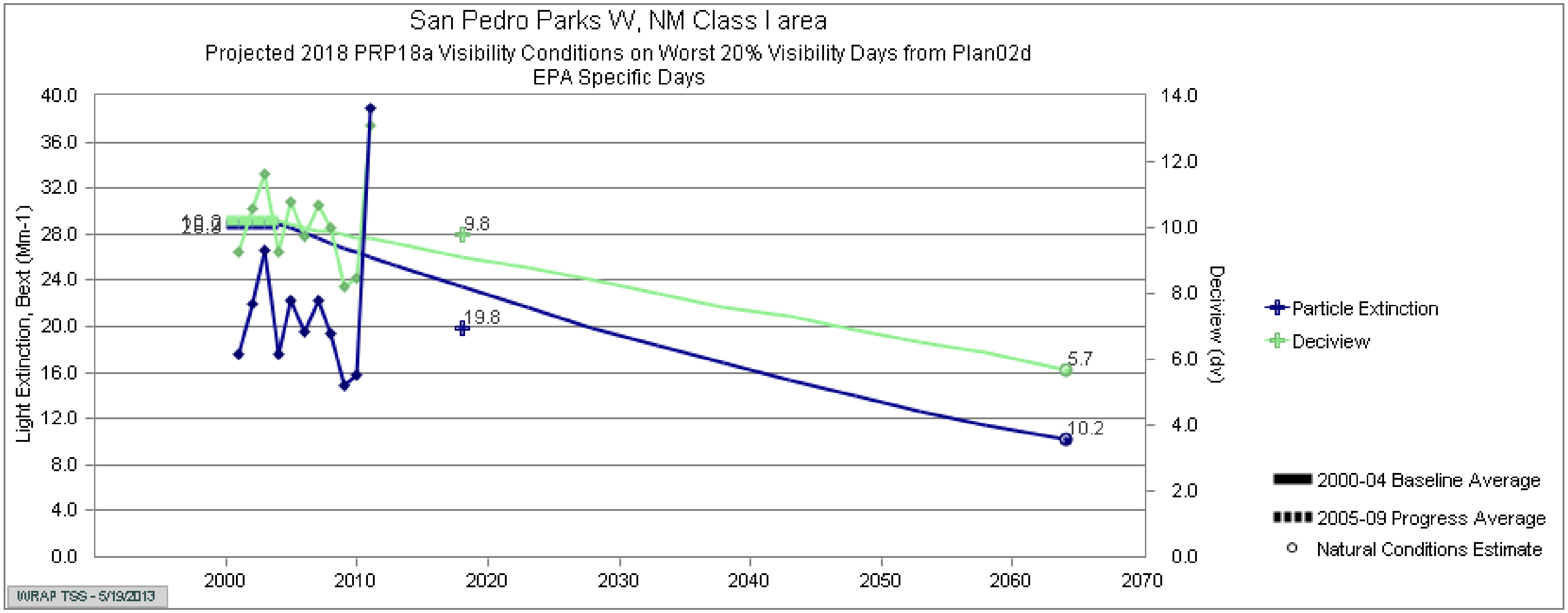

Figure S-10. Visibility conditions on worst 20 percent visibility days for San Pedro Parks Wilderness and glide path to 2064 goal

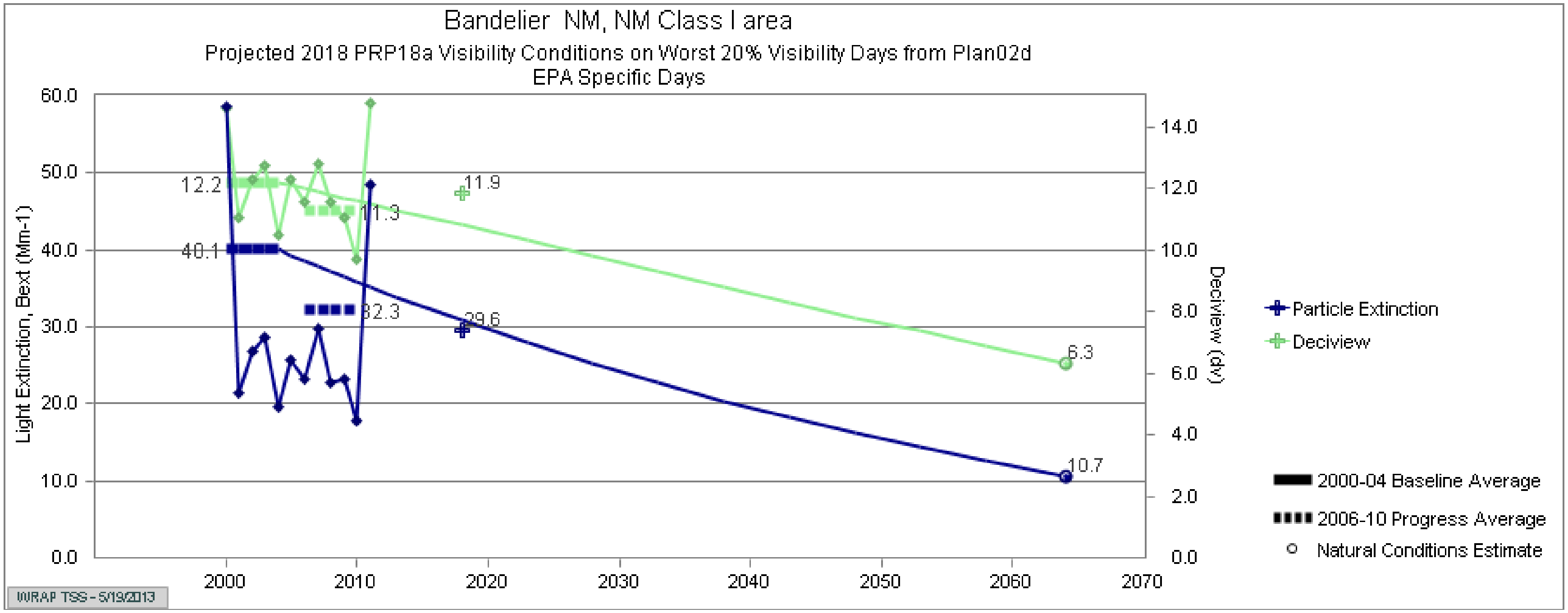

Figure S-11. Visibility conditions on worst 20 percent visibility days for Bandelier National Park and glide path to 2064 goal

Environmental Consequences to Air Quality

None of the methods for treating weeds would result in emissions great enough to have a significant impact on human health or visibility. Weed treatments would be widely distributed across both forests over time. Mandatory design features for protecting human health would continue to apply to herbicide application in municipal watersheds or in areas of human habitation, and with prescribed fire. Neither human health nor visibility would be affected by project activities.

Methodology

The mandatory design features for herbicide application and the scale of that and of the prescribed burns being proposed are such that both fall well below any limits for concern and meaningful quantification. Therefore only a qualitative discussion follows.

Alternative A – No Action

Under the no-action alternative, there would be no impacts to air quality because the project would not occur. Because there would be no direct or indirect effects, there would be no cumulative effects.

Alternative B – Proposed Action

Though alternative B would cause emissions, the amount would not be great enough to impact human health or visibility. In summary, since weed treatments would be widely distributed across both forests over time, human health and visibility would not be affected by project activities.

Gaseous emissions would originate from combustion of fuel in vehicles used to transport workers to and from treatment sites, vehicle mounted spray units applying herbicides, and from heavy equipment doing mechanical treatments such as mowing. The amount of gaseous exhaust emissions depends on size, age, and fuel efficiency of the engines; however, this is considered insignificant at this scale.

Vehicle traffic on forest roads would generate road dust. Dust caused by traveling to and from treatment areas would settle typically within a few minutes, leaving no lasting impact. Spraying herbicides from a vehicle would produce little road dust because the speed would be slow. Similarly, dust from annual road-side mowing or root plowing would be minimal due to slow vehicle speeds and the low frequency of treatments (annually).

During herbicide applications, spray drift is expected to be contained near the application site, due to limitations restricting application under wind conditions that could result in drift. In addition, drift will be limited because the slow vehicle speed and low height of the spray boom would resulting in the herbicide falling to the ground within a few feet of the target weed population.

Smoke from prescribed burning would release particulate matter (PM_{10} and $PM_{2.5}$) emissions. All prescribed burning used to treat weeds would comply with the New Mexico smoke management program requirement. The New Mexico Smoke Management Program is designed to prevent unhealthy conditions to human health and to protect visibility. Only a relatively small amount of acres per year would be treated by prescribed fire (approximately 100 acres per year maximum) to control for weeds and the vegetation being burned for the most part have a low fuel loading. In this case, a large amount of emissions is not expected and would fall well below standards.

Alternative C – No Herbicides

Alternative C would potentially create more dust because of more mowing and root plowing and more particulate emissions from prescribed burning than would occur under alternatives B or D. This would result in a slight increase in PM_{10} and $PM_{2.5}$ from dust and smoke. Otherwise, effects would be similar to alternative B. Because estimated emissions are low and these emissions would be distributed across the forests and over time, concentrations of pollutants would not affect air quality standards. Human health and visibility would not be affected by project activities.

Alternative D – Herbicides Only

Impacts on air resources from alternative D would be similar to those under alternative B, except less dust would be created because there would be no mowing, root plowing, or other treatments with potential to produce dust and there would be no smoke emissions from prescribed burning. Because estimated emissions are low and these emissions would be distributed across the forests and over time, concentrations of pollutants would not affect air quality standards. Human health and visibility would not be affected by project activities.

Cumulative Effects

The spatial boundary for the analysis of cumulative effects on air quality is contained within the following four airsheds as defined by New Mexico Environment Department (NMED): the Upper Rio Grande, the Middle Rio Grande, the Canadian River and the Pecos airsheds (NMED 2003). Airsheds are similar to watersheds in that they are defined geographic areas that, because of topography, meteorology, or climate, they are frequently affected by the same air mass. The difference with airsheds is that air masses and air pollutants move between airsheds mostly based upon larger meteorological patterns, rather than primarily by topography, as with water flowing through a watershed. However, for the purpose of this assessment, the area is contained to the counties identified earlier in this section for the same reason given.

Both current conditions for ambient air quality and visibility are good in the four airsheds that contain the project area. In terms of air quality impacts, neither human health nor visibility is expected to be impacted by project activities, and therefore there would be no cumulative effects. The particulate pollution and other contaminants in the air and the small amount of emissions produced during treatments at any given time and place would result in no noticeable cumulative increases in emissions within the airshed, even when considered with other ongoing and foreseeable future activities.

Effects of Forest Plan Amendment to Air Quality

Implementing future projects under the proposed amendment would have no effect on air quality, human health, or visibility. Mandatory design features for protecting human health would continue to apply to herbicide application in municipal watersheds or in areas of human habitation, and with prescribed fire. The effects described in this section would be the same under the plan amendment.

Heritage Resources

Affected Environment

Introduction

[Replaces third paragraph]

The FEIS, completed in 2005, tiered to the 2004 Programmatic Agreement (PA) titled "Invasive Weed Control" and was among the USDA Forest Service, Southwestern Region, Santa Fe and Carson National Forests, New Mexico Historic Preservation Officer, Advisory Council on Historic Preservation and in consultation with affiliated tribes. That agreement, however, expired in 2009. This draft SEIS adheres to the requirements laid out in "Appendix F - Standard Consultation Protocol for Noxious Weed Control" of the First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities. This agreement is binding among the national forests in New Mexico, New Mexico State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation; its purpose is to address applicable Section 106 of the National Historic Preservation Act requirements. Pursuant to the programmatic agreement, subsequent initiation of noxious weed control projects will be contingent upon completion of the identification and protection of historic properties, and compliance with applicable provisions of NHPA in accordance with appendix F.

[Replaces fourth paragraph]

Weed control methods such as manual and mechanized ground-disturbing treatments would need to follow the steps outlined in appendix F of the Standard Consultation Protocol. Other methods, such as biological methods or direct hand application of herbicides to target weed species, were considered to have little or no effect on heritage resources and are exempt from further consideration under Section 106. The programmatic agreement and appendix F is available in the project record.

[Replaces sixth and seventh paragraphs and table S-55 replaces table 45]

Heritage resource surveys have been conducted on approximately 221,805 acres (15 percent) of the 1.5-million-acre Carson National Forest, and 278,000 acres (17 percent) of the 1.6-million-acre Santa Fe National Forest. Approximately 5,970 heritage resource sites have been recorded on the Carson National Forest and 9,800 heritage resource sites have been recorded on the Santa Fe National Forest.

Table S-55 illustrates the number of known heritage sites completely within or intersected by currently inventoried weed infestations. Sites located completely within currently inventoried weed infestations on the Santa Fe National Forest consist of 101 sites with an average site size of 0.47 acre. Sites that intersect inventoried weed infestations on the Santa Fe National Forest consist of 215 sites with an average site size of 10.6 acres. Of the 10,020 acres of weed infestations on the Santa Fe National Forest, heritage sites encompass approximately 350 dispersed acres (3.5 percent) across the entire project area.

Sites located completely within currently inventoried weed infestations on the Carson National Forest consist of 17 sites with an average site size of 0.79 acre. Sites that intersect inventoried weed infestations on the Carson National Forest consist of 128 sites with an average site size of 15.6 acres. Of the 3,235 acres of weed infestations on the Carson National Forest, heritage sites encompass approximately 259 dispersed acres (8 percent) across the entire project area.

Table S-55. Affected heritage resource sites

National Forest	Total Sites	Sites Within Weed Infestations	Average Size (Acres)	Sites Intersect Weed Infestations	Average Size (Acres)
Santa Fe	316	101	0.47	215	10.6
Carson	145	17	0.79	128	15.6
Totals	461	118	N/A	343	N/A

Archaeological Resources

[Delete second paragraph, page 148]

Ethnographic and Traditional Cultural Property Resources

[Replaces 5th paragraph, page 149]

Traditional cultural properties are often difficult to identify during standard heritage resource surveys, and none have been identified in the areas of potential affect during scoping and tribal consultation activities conducted to date for this project. Scoping and consultation for the initial EIS was initiated in December of 2000, and an additional solicitation of comments was mailed to tribes in December of 2003, prior to release of the DEIS for public review. As a result of the expired Programmatic Agreement for the 2005 FEIS tribal consultation, the Carson and Santa Fe National Forest conducted consultation with tribes for this draft SEIS. Letters were mailed to the tribes on September 19, 2013.

Environmental Consequences to Heritage Resources

[No change from FEIS]

Effects of Forest Plan Amendment to Heritage Resources

[Additional section]

The proposed amendment will have limited effect to archaeological resources in future projects. Effects from herbicides on the analytical potential of perishable materials such as wood, ceramic paint, datable materials, and residues on artifacts has not been studied, but the overall effect is not likely to be adverse. Since little is known about the effects of herbicides on archaeological sites, monitoring will be used to collect additional data on this treatment method.

The proposed amendment will have a short-term effect to ethnographic resources in future projects. Traditional plant habitats could be affected by herbicidal application to eradicate weeds, and if so, would interrupt the plant collecting cycle for traditional communities. The timing of weed treatments, however, would take into account the traditional cyclic calendar of local communities as identified through scoping. Design features that include notifying tribes before the use of herbicides occurs will reduce the risk to plants used for traditional cultural purposes, and thus to the health of Native Americans who gather these plants (table S-11, rows 2, 10-12, 54-55).

With the design features and adaptive strategy applied to this and all future projects, no adverse effects to heritage resources (archaeological or ethnographical) are anticipated from the plan amendments. By controlling or eradicating weeds in this and future projects, an overall beneficial impact to soils is predicted; restoring native vegetation on soils generally reduces erosion, thereby increasing productivity and stabilizing heritage resources. The design features and adaptive strategies listed in table S-10 and table S-11 provide more protection to heritage resources than the existing forest plan standard. Thus, modifying the existing standard would not adversely affect heritage resources in this or future projects that apply herbicides.

Recreation and Wilderness

[Replaces entire section; figure S-12 replaces figure 12; figure S-13 replaces figure 13]

Affected Environment

Introduction

The affected environment and environmental consequences sections on recreation resources focus on current conditions, historic trends and environmental effects of each alternative in terms of recreation and wilderness areas. This section also describes past, present and foreseeable future land use activities that could contribute to cumulative impacts when combined with the effects of this project. The cumulative effects from those activities are described at the end of the environmental consequences section.

General Recreation Trends

Recreation has increased as a proportion of overall national forest use. Outdoor recreation, specifically the component on public lands, is a multibillion dollar industry (Laitos and Carr 1999). In fact, recreation on National Forest System lands increased 1,161 percent between 1950 and 1995 and the Outdoor Recreation Coalition of America reported that in 1997 more than 90 percent of Americans over 16 years old were participating in outdoor recreation activities (Laitos and Carr 1999).

Visitors to the Carson National Forest and Santa Fe National Forest are predominantly local. On the Carson National Forest, greater than 60 percent of the visitors come from towns and mountain communities in Taos County, while around 5 percent come from out of state (USDA 2008, updated 2012). On the Santa Fe National Forest, greater than 60 percent of visitors come from Santa Fe, Albuquerque, or towns adjacent to the forest (Jemez Pueblo, White Rock, Las Vegas) while fewer than 1 percent of visitors are international (Kocis et al. 2010). On both forests, visitors come from west Texas, Oklahoma, southern Colorado, and Kansas.

The most recent National Visitor Use Monitoring data for both forests are shown in table S-56. Of the estimated 1 million visitors for the year of the survey, about 80 percent contacted were visiting the Carson National Forest for the purpose of recreation. Of the estimated 1.5 million visitors during the survey year, about 65 percent contacted were visiting the Santa Fe National Forest for the purpose of recreation.

Developed Recreation

Developed recreation facilities include campgrounds, picnic areas, trailheads, and other areas containing specialized recreation facilities that are planned to accommodate a fixed number of people at one time. Currently there are approximately 54 developed recreation sites on the Santa Fe National Forest and 34 developed recreation sites on the Carson National Forest. On the Santa Fe National Forest, most weeds mapped in or near developed recreation sites are located along the Jemez River, where salt cedar, Russian olive and Siberian elm have overgrown fishing access sites and campgrounds (figure S-12). Invasive weeds are mapped within developed recreation sites on the Carson National Forest. The species include bull thistle and Canada thistle mapped at the June Bug, Elephant Rock and Cebolla Mesa Campgrounds on the Questa Ranger District, and Canada thistle at the Santa Barbara Campground on the Camino Real Ranger District. There are limited populations currently mapped within developed recreation sites, but the potential for expansion into more sites exists due to the existence of numerous weed populations along roads leading to recreation facilities on the two national forests.

Table S-56. Recreational visits to the Carson and Santa Fe National Forests

Activity	Carson National Forest FY 2008[a]		Santa Fe National Forest FY 2009[b]	
	% participating	% that consider primary activity	% participating	% that consider primary activity
Developed camping	3.9	0.4	5.1	2.3
Primitive camping	4.2	0.6	1.9	0.4
Backpacking	1.0	0.1	1.8	0.9
Resort use	1.3	0.0	0.7	0.0
Picnicking	4.9	1.3	7.7	1.7
Viewing natural features	30.9	4.1	32.4	9.5
Visiting historic sites	2.5	0.0	2.8	0.1
Nature center activities	1.5	0.1	4.2	0.0
Nature study	6.2	0.0	10.1	0.4
Relaxing	26.9	3.5	21.6	4.3
Fishing	7.2	5.8	9.1	5.3
Hunting	5.1	5.0	2.3	1.5
OHV use	2.4	0.8	0.4	0.0
Driving for pleasure	14.9	2.9	11.3	1.7
Snowmobiling	4.0	2.5	0.0	0.0
Motorized water activities	0.0	0.0	0.1	0.0
Other motorized activity	0.0	0.0	0.0	0.0
Hiking/walking	40.2	24.7	66.5	50.7
Horseback riding	1.4	0.0	0.6	0.1
Bicycling	1.0	0.2	2.6	2.0
Non-motorized Water	0.1	1.0	0.9	0.8
Downhill skiing	35.4	33.4	8.5	8.3
Cross-country skiing	8.2	6.9	9.4	9.1
Other nonmotorized uses	0.7	0.3	2.2	0.6
Gathering forest products	6.5	2.3	3.2	0.1
Viewing wildlife	23.6	0.7	22.2	0.6
Motorized trail activity	2.9	0.1	0.8	0.0
Some other activity	6.4	4.1	3.3	1.9
No activity reported	0.0	0.6	0.2	0.2

a. From the National Visitor Use Monitoring Results, USDA Forest Service, Region 3, Carson National Forest, 2008.

b. From the National Visitor Use Monitoring Results, USDA Forest Service, Region 3, Santa Fe National Forest, February 2011.

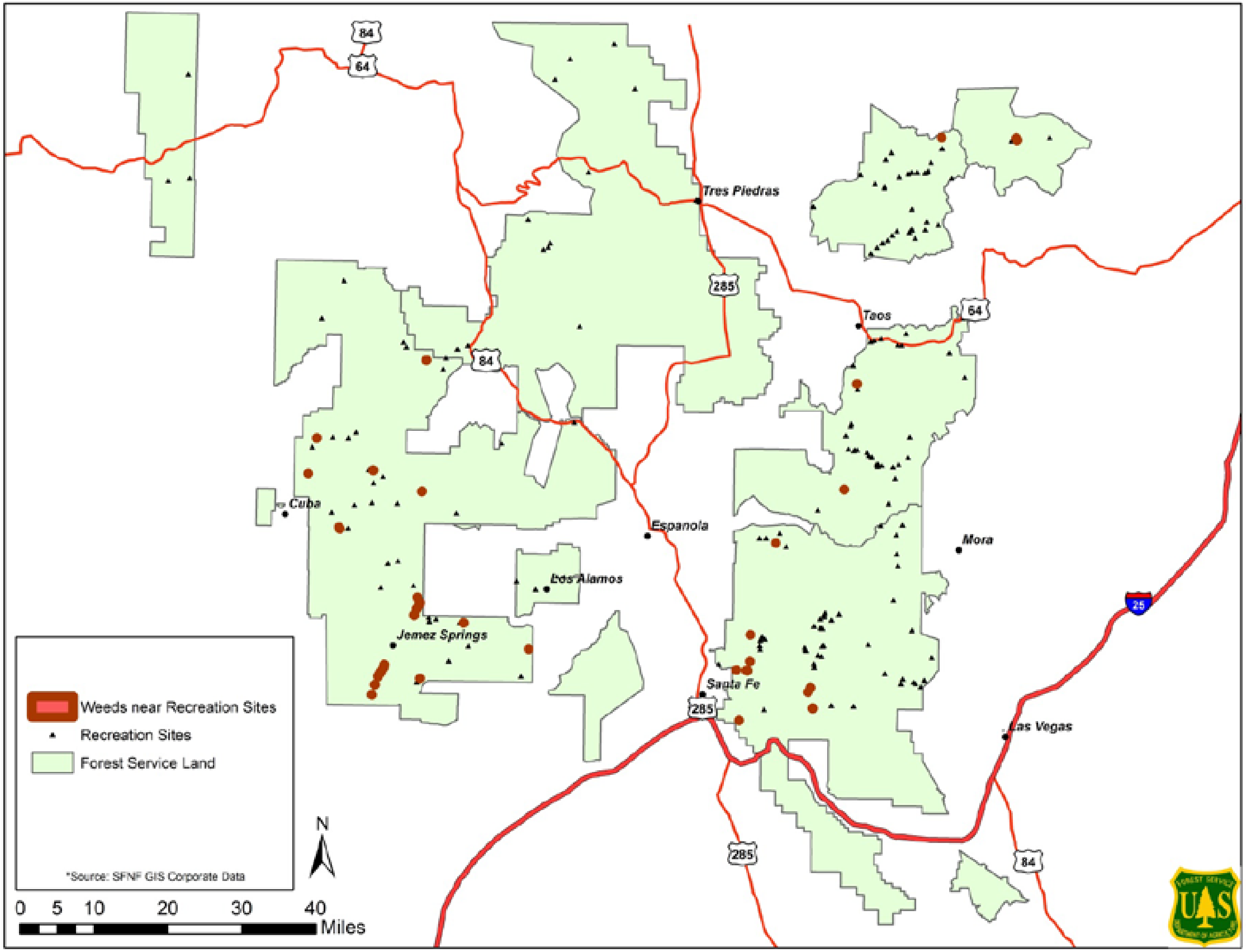

Figure S-12. Weeds located near recreation sites

Ski areas, organizational camps, and recreation residences (summer homes) are also included in this recreation category as “private sector” recreation. The Santa Fe Ski Area, Taos Ski Valley, Red River Ski Area, Enchanted Forest Cross Country Area, and Sipapu Ski Area are located within the two national forests. In addition, one Boy Scout camp, one Girl Scout camp and one YMCA camp are located within the two forests. Leafy spurge and bull thistle are currently growing on the Philmont Boy Scout Ranch, and yellow star thistle is growing on the Rancho del Chaparral Girl Scout Ranch.

Dispersed Recreation

Dispersed recreation includes activities in table S-56 that do not occur in developed facilities. Some developed recreation facilities such as trailheads, parking areas and vista points link with trails which facilitate a variety of dispersed recreation opportunities.

There are 1,095 miles of trails on the Santa Fe National Forest, including 208 miles designated for motorized use. Of these, about half are associated with the San Pedro Parks, Dome, Pecos, or Chama Wildernesses. There are 540 miles of system trail, including the Pecos Wilderness, on the Carson National Forest and 2,353 miles of system travel ways. Trail use is predominantly recreation oriented. Travel ways are used primarily as 4-wheel drive roads for recreation, livestock trails, and fire access routes.

Three nationally designated scenic byways are located on the two national forests: the Enchanted Circle Scenic Byway; the Jemez Mountain National Scenic Byway; and the Santa Fe National Forest Scenic Byway. Four congressionally designated wild and scenic rivers are all or partially on the two national forests: Rio Grande, Rio Chama, East Fork Jemez and Pecos Rivers. There are populations of Canada thistle, salt cedar and Russian olive along the Rio Chama Wild and Scenic River.

Most of the dispersed recreation occurs along streams and around waterbodies, as well as in wilderness and designated roadless recreation areas. Camping and other recreational activities in undeveloped areas often remove native vegetation and create disturbed soil conditions that are more susceptible to weed establishment. Horses and other pack animals frequently used for recreation on the two national forests, particularly in wilderness, can transport weeds, especially if hay and feed are brought in. Off road vehicle use is another common way for weed seeds to be spread along routes designated for off-highway vehicles.

Wilderness

Seven designated wildernesses and one wilderness study area are located on the two national forests, including Wheeler Peak Wilderness, Latir Peak Wilderness, Cruces Basin Wilderness, Pecos Wilderness, Chama Canyon Wilderness, San Pedro Parks Wilderness, Dome Wilderness, and the Columbine-Hondo Wilderness Study Area. Currently, about 560 acres of invasive weeds are mapped within wilderness areas on the two national forests. The potential for further expansion into and within the wildernesses is high due to the existence of numerous populations along roads and trails which provide access to the wildernesses.

Motorized and mechanized weed treatments are not allowed within wilderness. Forest Service Manual 2323.26b states:

> Approve plant control only for…:

b. Noxious farm weeds by grubbing or with chemicals when they threaten lands outside wilderness or when they are spreading within the wilderness, provided that it is possible to effect control without causing serious adverse impacts on wilderness values.

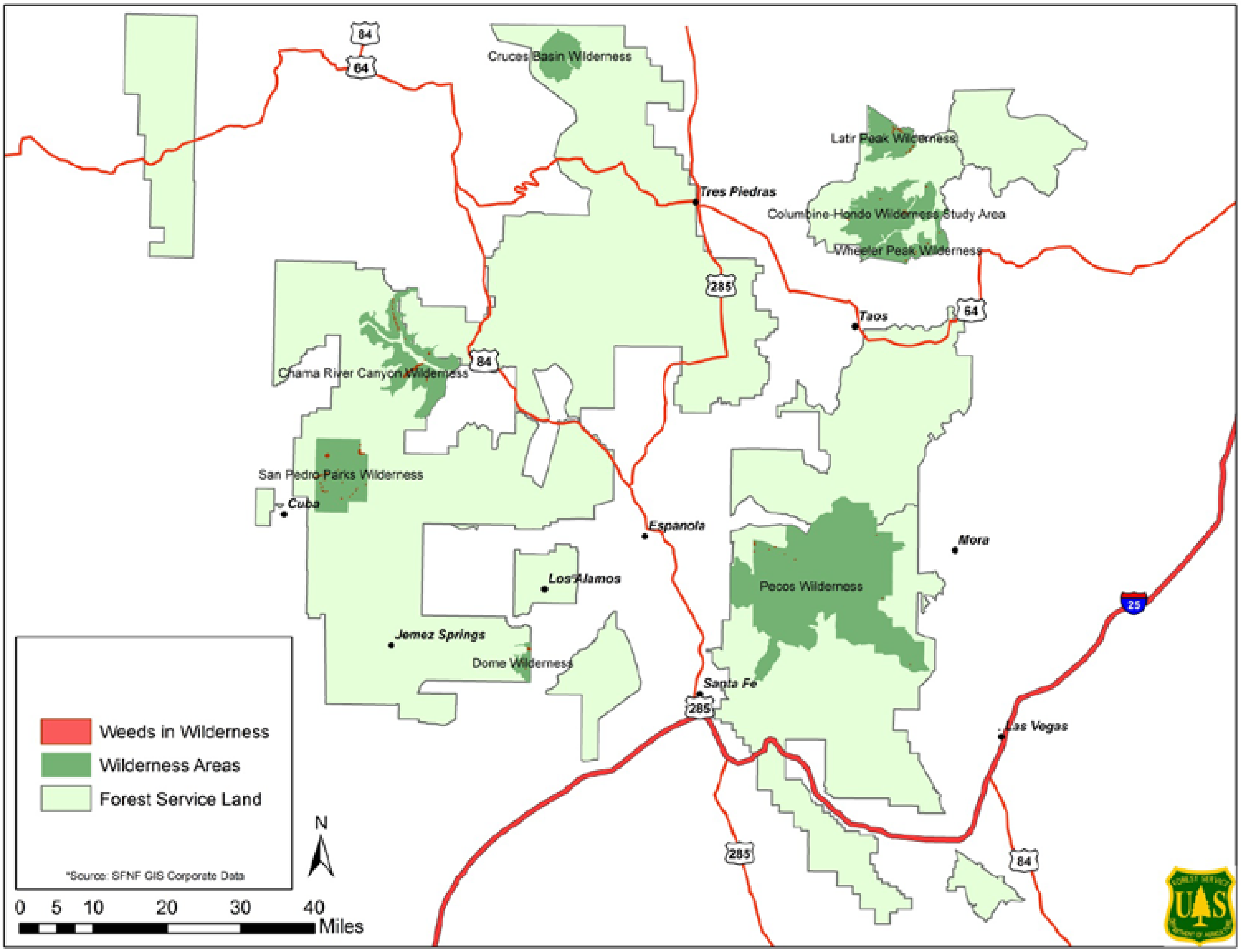

Figure S-13. Locations of weeds in wilderness areas

Herbicide treatments in wilderness areas require review and approval by the regional forester (FSM 2323.04c).

Wilderness character is composed of four qualities, which are:

1. Untrammeled – the primary ideal for wilderness where it is essentially unhindered and free from modern human control or manipulation.
2. Natural – where the natural condition of the land, its plants, wildlife, water, soil, air, and the ecological processes are managed, protected, and preserved.
3. Undeveloped –where wilderness retains its primeval character and influence, and is essentially without permanent improvements or human occupation.
4. Solitude or Primitive and Unconfined Recreation – where wilderness provides these types of recreation opportunities.

Environmental Consequences to Recreation and Wilderness

Summary

The principal relationship between recreation and invasive weeds is that recreation is a vector for spread of weeds. Direct and indirect impacts on recreation, both within and outside of wilderness, resulting from implementation of the action alternatives would include short-term encounters with weed treatment crews, short-term closures of areas during treatments, and visual impacts from wilting plants. In some cases herbicide treatment may be applied within a wilderness area. Some wilderness advocates would perceive that wilderness values were being reduced by the use of chemical weed control methods within wilderness. Cumulative effects resulting from action alternatives would be the protection of adjacent noninfested areas and preservation of intact plant communities, which would enhance recreation and wilderness experiences.

Direct and Indirect Impacts

Weeds can affect the recreation experience. Invading weeds such as spotted knapweed, Scotch thistle, and yellow star thistle detract from the desirability of using recreation sites and enjoyment of the wilderness. These species diminish the usefulness of sites because the stiff plant stalks, thorns, or sharp bristles can discourage or prevent walking, sitting, or setting up a camp. Weeds also detract from the recreation experiences by reducing the variety and amount of native flora to observe or study and reducing forage availability for wildlife and recreational livestock.

Alternative A

General Recreation Trends

Recreation on the forests is likely to cause the establishment of new weed populations, which would then spread at the assumed average rate of 8 percent per year. Weeds would typically spread along roads and motorized trails because motor vehicles are one of the main ways that weed seed gets spread around; and roadsides and adjacent areas, such as turnouts, campgrounds, and firewood gathering areas, are usually disturbed, which favors the proliferation of most weed species.

The spread of weeds would degrade recreational values for people who understand and value natural conditions. The National Visitor Use Monitoring survey data (table S-56—Santa Fe

National Forest) indicate that 32 percent of visitors surveyed enjoy viewing natural features, 10 percent enjoy nature study and 22 percent enjoy viewing wildlife.

Hunting opportunities would be reduced over time as weeds reduce the quality of forage and cover habitat for many wildlife species (refer to “Wildlife Resources” section).

Weeds such as spotted knapweed, Scotch thistle, and yellow star thistle would diminish the desirability of dispersed recreation opportunities because the rigid plant stalks, thorns, or sharp bristles would discourage or prevent walking, sitting, or setting up a camp.

Recreational experiences and values would especially decline where tall, dense weeds such as salt cedar dominate and limit access to riparian areas and stream banks. The dense thickets of salt cedar along the Green River in Desolation Canyon have eliminated many of the campsites used by river runners for the first 20 miles downriver from the BLM Sand Wash boat ramp. Weed species that cause allergies (hay fever, skin reactions) would also diminish recreational experiences for susceptible people.

On the other hand, this alternative avoids the temporary closures of some recreation sites, trails or roads during and immediately after treatment activities.

Wilderness

The no-action alternative would have the following effects on the four wilderness characteristics:

1. Untrammeled – Not allowing any treatments in wilderness would preserve the untrammeled quality of wilderness.
2. Natural – Not allowing any treatments in wilderness would result in the proliferation of weeds over time. This would not manage, protect, or preserve its natural ecological processes. This assumes that weed proliferation outside and introduction into Wilderness is not a natural ecological process.
3. Undeveloped – The no-action alternative would have no effect on this quality because no permanent improvements or permanent occupation would occur.
4. Solitude or Primitive and Unconfined Recreation – The no-action alternative would preserve solitude and primitive and unconfined recreation because no treatments would occur.

Alternative B

General Recreation Trends

Recreation on the two national forests is likely to cause the establishment of new weed populations, which would then spread at the assumed average rate of 8 percent per year. Under this alternative, the Forest Service expects to be able to control or eradicate new populations. Because the new populations are most likely to establish along roads and trails, Forest Service personnel would be able to get to them easily for treatment.

The negative effects predicted for alternative A would not occur or would occur to a lesser degree, depending on how effectively new populations are eradicated.

Developed and Dispersed Recreation

Herbicide applications and other treatments may cause temporary visual disturbances to some people who encounter weed treatment personnel; however, on most sites treatments would only last a few days or less. There would be an insignificant increase in the amount of noise and traffic associated with these treatment activities, primarily due to the short timeframe needed to treat weeds at most weed infestation sites, and the relatively small number of personnel needed to implement treatments. Proposed treatments typically do not require large crews of workers such as those frequently used on the two national forests for thinning, prescribed burning, watershed restoration and other common projects.

Temporary closure of roads, trails or recreation sites during and immediately after herbicide applications would have a minimal impact on recreational opportunities because they would not typically last more than a day or two, and would occur during weekdays.

Odors emitted by herbicides could cause anxiety in persons unaware of their presence, although it is unlikely that herbicides would be applied along trails or in recreation sites during a time when visitors are present because the Forest Service would close sites during herbicide application. Signs would be posted at access points to recreation sites, roads or trails where herbicides would be used. (The "Human Health and Safety" section describes the effects of herbicides on human health in detail).

Areas of wilting, dying or dead weeds, and weeds removed, cut or burned, would be apparent for a short time in the localized treatment sites, which would diminish the natural appearance of the treatment site. Within a growing season or two, early-seral vegetation would fill in and become more noticeable than the dead plants or bare soil areas.

Wilderness

The effects of alternative B on the four wilderness characteristics would be as follows:

1. Untrammeled – For some people, the sight of agency personnel spraying herbicides or hand grubbing weeds within a wilderness may diminish the quality of their wilderness experience.
2. Natural – Controlling weeds would promote native plants, which would be managing the natural condition of the land, its plants, wildlife, water, soil, air, and the ecological processes.
3. Undeveloped – Alternative B would have no effect on this quality because no permanent improvements or permanent occupation would occur.
4. Solitude or Primitive and Unconfined Recreation – No effect on solitude or primitive and unconfined recreation is expected because the acreage needing treatment is tiny compared to the acreage of the wildernesses. Temporary closures of sites during treatment are possible; the closures would generally last less than a week.

Alternative C

General Recreation Trends

Alternative C would not be as effective at controlling newly established weed populations caused by recreational activities. The result on general recreation trends would be the same as alternative A but to a lesser extent.

Developed and Dispersed Recreation

Due to the need for additional repeat treatments, there would be a slight increase in the amount of noise and traffic associated with treatments on the forest. Some recreation sites and trails being treated with manual or other nonherbicidal methods would not need to be temporarily closed to the public, which would maintain more recreation opportunities, especially for visitors who are exceptionally sensitive to chemically treated environments.

Wilderness

The effects of alternative C on the four wilderness characteristics would be as follows:

1. Untrammeled – For some people, the sight of larger numbers of agency personnel treating weeds within a wilderness may diminish the quality of their wilderness experience, compared with alternative B.
2. Natural – Controlling weeds would promote native plants, which would be managing the natural condition of the land, its plants, wildlife, water, soil, air, and the ecological processes; this alternative would be less effective than alternative B, because small isolated populations are difficult to monitor and applying more repeated treatments for effective control would be more difficult.
3. Undeveloped – Alternative C would have no effect on this quality because no permanent improvements or permanent occupation would occur.
4. Solitude or Primitive and Unconfined Recreation – No effect on solitude or primitive and unconfined recreation is expected because the acreage needing treatment is tiny compared to the acreage of the wildernesses.

Alternative D

General Recreation Trends

Effects under alternative D would be similar to effects under alternative B above. A slight difference in effects would involve the fact that ground-disturbing activities such as mowing, tilling, digging, or burning, which most often need to be repeated in order to meet objectives, would not be implemented. The effect over time would be a reduction in noise and traffic along roads and trails and within recreation sites during treatment activities.

The effects of alternative D on the four wilderness characteristics would be as follows:

1. Untrammeled – For some people, the need for fewer people performing weed control would diminish the sense of excessive human intervention, compared with alternatives B and C.
2. Natural – Controlling weeds would promote native plants, which would be managing the natural condition of the land, its plants, wildlife, water, soil, air, and the ecological processes. This alternative would be less effective than alternative B for species that are most effectively controlled by nonherbicide methods; and more effective than alternative C for species most effectively controlled by herbicides.
3. Undeveloped – Alternative C would have no effect on this quality because no permanent improvements or permanent occupation would occur.
4. Solitude or Primitive and Unconfined Recreation – No effect on solitude or primitive and unconfined recreation is expected because the acreage needing treatment is tiny compared to the acreage of the wildernesses.

Cumulative Effects to Recreation and Wilderness

The cumulative effect of the no-action alternative would be an increase in the establishment of new weed populations. The direct and indirect effect of the no-action alternative is that new weed populations are likely to become established as a result of recreational activity. This would add cumulatively with other actions that cause the establishment of weeds, such as wildfires, some prescribed burns, construction of facilities, road maintenance, and firewood collection. The cumulative effect on recreation would be a decrease in the quality of recreational activities due to weeds with thorns and allergens and due to a loss of native vegetation.

The direct and indirect effect of the action alternatives and the cumulative effect are shown in table S-57.

Table S-57. Cumulative effects to recreation and wilderness resources

Direct and indirect effect	Actions contributing cumulatively to the direct and indirect effect	Summary of cumulative effect
Loss of recreational opportunity where sites are closed during treatments, normally 1 to 5 days	The publication of Motor Vehicle Use Maps has reduced the places where people can drive in the forests. Areas are closed during administrative projects, such as prescribed burns and thinning operations. During times of high fire danger, the entire project area can be closed for several weeks.	Negligible. Weed treatments will be widely dispersed and closures will last for brief periods of time. This means that people will still have ample opportunity for recreational activity across the project area.
Visual disturbance from wilted, dead, or dying plants	Prescribed burns, wildfires, and drought are the primary things that cause plants to die.	Negligible because both the effects last a season or less and are not likely to occur in the same places.
Noise and visual disturbance from crews performing treatments, including in Wilderness areas	All activities conducted by forest personnel, such as prescribed burning, thinning operations, trail maintenance, cleaning recreational facilities, performing monitoring activities, laying out sites, and suppressing wildfires all cause noise and visual disturbance.	Negligible. No additional forest personnel will be hired to treat weeds, so there would be no net increase in activities.

Effects of Forest Plan Amendment to Recreation and Wilderness

Part of the Santa Fe Municipal Watershed is located in designated wilderness. The effect of the forest plan amendment on wilderness during future projects depends on the municipality’s willingness to treat weeds using herbicides. If the municipality agrees to the use of herbicides (shown to be the most effective treatment against weeds in general), with the design features in place, the overall effect would be to promote the natural characteristic of wilderness by promoting native vegetation. Conversely, if the municipality prohibits the use of herbicides, then the natural characteristic might be compromised if weeds spread more quickly than the Forest Service can control them.

The plan amendment allows treatment in “areas of human habitation”, which is interpreted as recreation sites for this portion of the analysis. The effects of the amendment would be no different than those described in the direct, indirect, and cumulative effects because this project incorporates many elements (table S-10 and table S-11) designed to protect human health and safety.

Visual Resources

[Replaces entire section]

Affected Environment

Visual Quality Objectives

Five visual quality objectives have been prescribed in the Carson and Santa Fe National Forests' forest plans. The visual quality objectives categorize lands according to scenic quality and viewer sensitivity. They are: preservation, retention, partial retention, modification, and maximum modification. Preservation, for example, is the visual quality objective assigned to wilderness areas. When originally developed, the visual quality objectives described the existing condition of the national forests' viewsheds. The visual quality objectives are not binding elements of the forest plans; however, the Forest Service makes every effort to ensure that its management actions align with the existing visual quality objectives. See The Visual Management System (USDA Forest Service 1984) for definitions and descriptions of the visual quality objectives and the Carson and Santa Fe National Forest Plans (USDA Forest Service 1986b and 1987b) for how visual quality objectives were applied to each of the national forests.

Though visual quality objectives have been established for both forests, they have not been completely mapped in electronic (GIS) format. Due to technological changes and budget constraints, the visual quality objectives have not been completely transferred from old Forest Service mylar maps. For example, 62 percent of the Santa Fe National Forest (mainly the west side) has the visual quality objectives mapped in the GIS dataset.

Visual Elements

Four visual elements—form, line, color and texture—exist in any landscape. Depending on their composition and where they are viewed from, they exert differing degrees of influence.

- **Form**: Landscape forms are determined by topography and vegetative pattern. The weed populations in the project area are relatively small and thus are indiscernible beyond foreground (up to ½ mile) views. Weeds do not dominate viewsheds in the project area.
- **Line**: Line is anything that is arranged in a row or sequence. It can be the silhouette of a form, the edge of a meadow, a ridgeline, a tree trunk, a river, the path of an avalanche, a road. Weeds, being plants, conform to the line of surrounding vegetation.
- **Color**: Color enables people to distinguish among objects of identical form, line and texture. Weeds are plants; thus, their colors conform to the surrounding vegetation and natural environment.
- **Texture**: Textures in the landscape are determined by geology, soils, topography and vegetation. Weeds, as plants, conform to the textures of a forested or grassland environment.

Environmental Consequences to Visual Resources

Summary

Under the no-action alternative, the four visual elements would not noticeably change for many years.

Under all action alternatives, treating weeds would have a temporary effect on visual elements. All visual effects would be temporary because native vegetation is expected to grow back within a season or less. Further, all visual effects would be small because weed populations are currently small relative to the project area as a whole. Known weed populations cover 0.4 percent (13,256 acres) of the National Forest System lands in the project area (3,030,721 acres). The largest mapped patch of weeds is 2,793 acres of Canada thistle on the Santa Fe National Forest. The treatment sites are small and would not alter the overstory tree cover; thus, there would be minimal changes in form, line, color or texture in the environment.

Direct and Indirect Effects

Visual Quality Objectives

All the alternatives conform to the visual quality objectives assigned. The no-action alternative conforms with visual quality objectives because weeds were part of the visual landscape when the visual quality objectives were assigned.

Under the action alternatives, weed treatments would meet visual quality objectives. The visual effects of treatments, which are dead or dying plants, are temporary. Brown, dead, or dying vegetation would last no longer than it takes for native vegetation to grow back, normally a season. Dead or dying vegetation is a natural phenomenon, especially given the current drought. Even weed control treatments applied in designated wilderness would be expected to conform to the visual quality objective of preservation since treatments would not substantially alter the form, line, color or texture of the landscape, or create a stark contrast with the surrounding vegetation.

Visual Elements

Alternative A

Under alternative A, weeds are expected to spread at an average rate of 8 percent per year.

- **Form:** Over many years, weeds could dominate viewsheds. This, however, would not represent a significant change from the current landscape forms, which are dominated by “carpets” of trees or grass at the middleground and background views (photo 5).

Photo 5. Aerial view; example of current forest conditions in much of the project area. Note the uniform form, line, and texture.

- **Line**: Without weed treatments, there would be no change in visual lines. Even with the continued spread of weeds, the lines formed would not be different from that presently found in a forested or grassland environment.
- **Color**: There would be no change in color if weeds are not treated. Weeds, being plants, have colors naturally present in a forested or grassy environment.
- **Texture**: Because weeds are plants, there would be no change to visual texture from what is currently expected in a forested or grassland environment if weeds are not treated.

Alternatives B, C, and D

Overall, the treatment sites are small and would not alter overstory tree cover, thus there would be minimal changes in form, line, color or texture in the environment. Of the 78 patches of weeds, 13 (17 percent) are 200 acres in size or greater. Any visual effect to the four visual elements would be temporary (normally a year or less), lasting until native vegetation grows back.

- **Form**: Because weed populations do not dominate viewsheds, treating them would not change landscape form in the middleground or background. In the foreground, people might observe dead or dying plants until native vegetation grows back; however, the presence of dead or dying vegetation is not uncommon in a forested environment and thus would not differ from current forms.

  In the foreground view, the visual impacts resulting from mowing, hand grubbing, and hand pulling would be a change in the form because these methods result in localized soil disturbance. Root plowing would be more noticeable. Biological methods would not be visually noticeable in the foreground other than dead or dying weeds. Use of prescribed fire would cause the burned vegetation to appear brown or blackened for a short period of time, and may result in patches of bare soil until the site is revegetated, similar to the visual effect of a naturally caused surface fire.

- **Line**: Treating weeds would result in new lines, where the edge of treatments (brown areas) would abut green areas. Lines from mowing, hand grubbing, and hand pulling would be noticeable in the foreground until native vegetation grows back; lines from prescribed fires could be noticeable in the middleground as well. The lines created by weed treatments would be normal in a natural setting in that they would not be straight.
- **Color**: Treating weeds from any method would result in brown vegetation. The color brown is not uncommon in a forested environment. The use of prescribed fire would cause blackened vegetation, also not uncommon in a forested environment. Because the color changes would be natural to a forested or grassy environment, there would be no direct or indirect effect.
- **Texture**: Dead and dying plants are part of the natural texture of a forested environment (e.g., piñon die-off of 2002 and wildfires); thus, treating weeds would not result in any unusual textures in the project area. Ground-disturbing methods, such as hand-pulling or mowing, would impact texture in the foreground by removing plants and leaving bare soil exposed until native vegetation grows back, normally a season.

Cumulative Effects to Visual Resources

Visual Quality Objectives

Because there would be no direct or indirect effect to visual quality objectives from any of the alternatives, there would be no cumulative effects.

Visual Elements

Because alternative A (no action) has very little direct or indirect effects to the four visual elements, it would have no cumulative effects.

Table S-58 shows the anticipated cumulative effects for all action alternatives (B, C, and D) to the four visual elements.

Effects of Forest Plan Amendment to Visual Resources

The proposed plan amendment would have no effect to visual quality on future projects beyond what has been described in this section. The same effects to form, line, color, and texture described for this project would be the same for future projects under the plan amendment, which addresses where herbicides may be used.

Table S-58. Cumulative effects of action alternatives to visual quality

Item	Direct / Indirect Effect	Overall cumulative effect	Past, present, and reasonably foreseeable future actions that cumulatively contribute to the effect
Form	No effect in middle- or background. Temporary change in form due to dying vegetation or ground disturbance.	No direct or indirect effect; thus, no cumulative effect to middle- or background. The effect of weed treatments in the foreground would contribute a negligible cumulative effect to form. It is unlikely, for example, that the change in form caused by weed treatments would be noticed against something like the Las Conchas Fire, or the oil and gas pads present on the Jicarilla Ranger District.	Road construction and maintenance Trail construction and maintenance Creation of unauthorized routes Construction and reconstruction of recreational facilities (such as campgrounds, fishing access, toilet installations) Subdivision and development of private inholdings and land adjacent to the two national forests Mining claims and development of mining Wildfires, including suppression and rehabilitation Hazardous fuels treatment and prescribed burning Livestock grazing Road decommissioning Forest product collection Administrative use Weed treatments on land in other jurisdictions Oil and gas leasing Preparation of travel management plans and motor vehicle use maps by national forests and other agencies Special Use Permits – acequia improvements, ROW for pipelines (water/natural gas), driveways,
Line	Temporary change in line where treated areas abut untreated areas.	The effect of weed treatments on line would be negligible when considered in context of the activities listed at left. The lines created by treatments would be relatively small because of the small patch sizes, temporary, and would be “natural” in the sense that they would not be straight.	
Color	No effect.	No direct or indirect effect; thus, no cumulative effect.	
Texture	Temporary effect of bare soil as a result of ground	The cumulative effect to texture as a result of treating weeds would be negligible	

Item	Direct / Indirect Effect	Overall cumulative effect	Past, present, and reasonably foreseeable future actions that cumulatively contribute to the effect
	disturbance.	when considered in context with the activities listed at left. The size of patches to be treated is relatively small, and the effect would be temporary because of the mitigation to ensure that bare ground is revegetated.	communication sites, outfitter/guides, etc. Geothermal leases in Coyote, Cuba and Jemez Ranger districts Oil and gas leases in Cuba Ranger District Oil and gas development on the Jicarilla Ranger District

Livestock Grazing

[Replaces entire section]

Affected Environment

Effects of Weeds on Livestock

Most livestock (and wildlife) depend on rangelands for survival. Some weeds, such as larkspurs and locoweeds, are toxic when grazed (DiTomaso 2000). Weeds, due to their low palatability or toxicity, can also reduce the forage available to livestock if extensive populations exist. Particularly troublesome are knapweeds because they are low in palatability and readily invade both disturbed and undisturbed sites (DiTomaso 2000). Downy brome (cheatgrass) is the most dominant weed in the West; though it can be used as forage, in some years it only provides 10 percent of productivity of the perennial species it replaced (McHenry and Murphy 1985).

Effects of Livestock on the Spread of Weeds

Domestic livestock, particularly sheep, cattle, and horses, have grazed in the project area for over 200 years. Livestock grazing over an extended period of time greatly changes the plant composition from the original ecosystems and can result in the presences of weeds (Endress et al. 2012, Murphy 1986). LeJeune (2001) describes how weeds are more successful competitors when nitrogen in soils is present, a situation that chronic livestock grazing (along with fire suppression) has enhanced.

In the project area, the extent to which domestic livestock grazing has caused the spread of weeds is not known. Because the acreages of weeds in the project area are low, it can be assumed that grazing management on the two national forests has been effective (e.g., preventing severe overgrazing) at controlling the establishment and spread of weeds. Stipulations in grazing permits, such as not being allowed to feed hay on national forest lands, have likely prevented new weed populations from establishing.

The next two tables show the livestock grazing allotments administered by each national forest and the acres of known weed infestations in each allotment.

Table S-59. Grazing allotments with known weed infestations on the Carson National Forest

Name of Allotment	Size of Allotment (acres)	Acres with Weed Infestation*	Percent of Allotment Infested with Weeds (nearest percent)
Angostura	17,716	0	0
Arroyo Hondo	18,974	2	0
Bancos	16,526	12	0
Black Copper / Red River	10,418	2	0
Black Lakes	12,038	0	0
Bobcat	6,284	3	0
Cabresto	26,907	256	1
Capulin	13,745	0	0
Carracas	32,554	331	1
Carson-Mojino	7,615	8	0
Columbine	9,016	1	0

Name of Allotment	Size of Allotment (acres)	Acres with Weed Infestation*	Percent of Allotment Infested with Weeds (nearest percent)
Deer Creek Complex	5,379	1	0
East Piñon	3,051	1	0
El Rito Lobato	95,948	376	0
English	8,234	0	0
Flechado	6,365	1	0
Goose Creek	6,568	2	0
Jarita Mesa	63,676	5	0
La Cal	5,148	0	0
La Lama	15,628	8	0
Laguna Seca	29,122	31	0
Lakefork Baldy	8,271	19	0
Main Fork	4,191	2	0
Mesa	9,578	1	0
Midnight/Mallette	24,859	43	0
Miranda	8,069	30	0
Mogote	16,594	0	0
Olla-Ranchos	68,035	148	0
Private Land	61,214	24	0
Recreational	266	0	0
Red River	22,006	14	0
Rio Chiquito	29,129	6	0
Rio Pueblo	33,967	5	0
Rito Segundo	8,594	5	0
San Antone	41,843	13	0
San Antonio Mountain	7,478	0	0
San Cristobal	21,368	10	0
San Gabriel	3,969	1	0
Santa Barbara	34,235	39	0
Santos	8,800	5	0
Sawmill Park	2,055	1	0
Servilleta	10,263	2	0
Ski Area	1,167	0	0
Spring Creek	25,086	21	0
Sublette	10,940	0	0
TCLP	40,227	7	0
Tio Gordito	27,998	8	0
Tio Grande	31,986	32	0
Trampas	27,549	1	0
Tusas	43,641	0	0
Valencia	20,933	41	0
Valle Vidal	101,293	1,515	1
Vaqueros	31,818	175	1

* A zero means that less than 1 acre is infested with weed(s).

Table S-60. Grazing allotments with known weed infestations on the Santa Fe National Forest

Name of Allotment	Size of Allotment (acres)	Acres with Weed Infestation*	Percent of Allotment Infested with Weeds (nearest percent)
Alamo	22,478	227	1
Aspen Mountain	17,372	53	0
Barbero	19,185	362	2
Bear Lake	41,446	1	0
Bear Springs	2,301	0	0
Bland Canyon	8,814	0	0
Bull Creek	14,636	4	0
Caja del Rio	66,873	50	0
Capulin	7,214	230	3
Cebolla / San Antonio	26,171	11	0
Chama	40,423	330	1
Chicoma	2,899	0	0
Chiquito	13,185	23	0
Colonias	24,073	45	0
Coyote	21,607	313	1
Cuba Mesa	7,374	96	1
Del Norte	7,890	4	0
Dome	3,426	1	0
El Cielo	12,175	4	0
El Invierno	45,695	114	0
El Pueblo	26,753	1	0
French Mesa	25,203	187	1
Gabaldon	8,571	46	1
Gallina Mountain	11,188	8	0
Gallina River	22,409	1,135	5
Glorieta	35,164	19	0
Gurule	8,361	1	0
Horse Thief	20,538	0	0
Jarosa	23,369	911	4
La Jara	17,549	104	1
La Presa	11,385	133	1
Las Conchas	1,396	2	0
Llaves	11,423	92	1
Los Indios	7,617	131	2
Macho	38,257	186	0
Mesa Alta	37,243	720	2
Mesa de las Viejas	20,942	2	0
Mesa del Medio	17,331	242	1
Mesa Poleo	25,972	530	2

Name of Allotment	Size of Allotment (acres)	Acres with Weed Infestation*	Percent of Allotment Infested with Weeds (nearest percent)
Ojito Frio	10,603	45	0
Ojitos	18,527	29	0
Oso Vallecitos	44,991	6	0
Palomas	5,282	2	0
Penas Negras	16,734	69	0
Peralta	12,882	7	0
Pine Springs	30,949	5	0
Pollywog	20,845	64	0
Polvadera	21,027	16	0
Private land	29,566	2	0
Quemado	24,373	67	0
Recreational	4,106	260	6
Red Top	9,927	22	0
Rio de la Casa	17,882	18	0
Rosilla	18,763	46	0
San Diego	102,739	984	1
San Jose	13,775	0	0
San Luis	39,730	249	1
San Miguel	21,916	176	1
San Pedro	21,634	53	0
Santa Fe Watershed	24,458	44	0
Sapello	6,601	0	0
Senorito	21,672	143	1
Sierra Mosca	44,531	3	0
Simon	12,506	4	0
Soldier Creek	15,883	98	1
South Ojitos	9,712	42	0
Springs	29,789	153	1
Tecolote	11,082	78	1
Vacas	8,034	46	1
Valle Osha	8,967	0	0
Vallecitos	16,255	272	2
V-Double Slash	37,408	39	0
Youngsville	31,729	659	2

* A zero means that less than 1 acre is infested with weed(s).

Between 0 and 2 percent of most allotments are infested with weeds. The two largest acreages of infestations are on the Valle Vidal and the Gallina River allotments. The acreage of weeds on the Valle Vidal allotment reflects the effects of the 2002 Ponil Fire because weeds tend to colonize disturbed areas. Bull thistle became established primarily along drainages and at the base of burned evergreens within the high-intensity burned areas. In the San Diego Allotment, the majority of the weeds consists of salt cedar along the Jemez River. Permitted livestock grazing has not been allowed along the lower Jemez River area since 1980. Prior to that time, much of it was privately owned. Since then, it has been designated as a national recreation area and several recreation sites have been developed.

Table S-61 shows the wild horse and burro territories in the project area. None is occupied. These overlap with cattle grazing allotments, so the acres of weeds present are counted in table S-59 and table S-60.

Table S-61. Wild horse territories

National Forest	Name of Wild Horse or Burro Territory	Acres	Acres with weeds (known as of Aug. 1, 2013)	Overlaps with cattle grazing allotment(s) listed here
Carson	Jicarilla	75,987	598	Carracas Cabrestos Bancos
	Yso/Montosa	21,579	0.08	Canjilon Mogote El Rito Lobato
Santa Fe	Caja del Rio	12,500	0	Caja del Rio Cochiti Pueblo (tribal)
	Chicoma	2,899	0	Chicoma Oso Vallecitos
	Dome	3,426	0.8	Alamo
	Mesa De Las Viejas	20,942	2	Gallina Mountain Rio Chama
	San Diego	2,274	0	San Diego

Environmental Consequences to and from Livestock Grazing

Alternative A

Effects of Weeds on Livestock

That the acreage of weeds currently present in the allotments is low means that the availability of forage is high, and the risk of livestock poisoning is low. Without treatment, however, weeds would continue to displace palatable native vegetation and reduce forage. This is likely to take many years and should not be an immediate concern to permittees, but it should be a long-term concern. Weeds, once established, are persistent. Should weeds become the dominant plants on the allotments, they would be extremely difficult and expensive to remove (Frid et al. 2013).

Effects of Treatments on Livestock

Under the no-action alternative, there would be no risk of negative effects from treatments because they would not occur.

Effects of Livestock on the Spread of Weeds

There would be no change from what is described in the affected environment because this project does not propose to alter grazing practices.

Alternatives B and D

Effects of Weeds on Livestock

Presently, the amount and species of weeds that exist on the two national forests have not, in any real sense, reduced the amount of forage available for domestic livestock because the weeds compose a small percentage of the available forage on the allotments. Thus, the effect of alternatives B and D would be to prevent such a loss from occurring. Under alternatives B and D, the Forest Service expects to have controlled or eradicated the weed populations within a decade. This means that native vegetation would be restored or promoted, resulting in long-term beneficial effects on the allotments. There would be increases in density and vigor of native and desired forage grasses within proposed treatment areas (See “Vegetation Resources” section for more detail). There would be beneficial effects on soil and water resources that are important in maintaining quality rangeland conditions (See “Water Resources” and “Soil Resources” sections for more detail).

Because alternatives B and D would control or eradicate the weeds that are toxic to domestic livestock, there would be a reduction in the risk of toxic effects to cattle from ingesting weeds. The two national forests are not currently at a level of infestation where weeds are displacing grazing opportunities except in very small, localized situations. Over the long term, control measures taken now would avoid more significant impacts in the future.

Effects of Treatments on Livestock

No effects from treatments to livestock are expected to occur, because the project design includes working with livestock permittees as to the treatment schedule. It is anticipated that permittees would manage their livestock so as to avoid potential effects.

Effects of Livestock on the Spread of Weeds

There would be no change from what is described in the affected environment because this project does not propose to alter grazing practices.

Alternative C - No Herbicides

Effects of Weeds on Livestock

Alternative C would result in the same type of beneficial effects as alternatives B and D, but to a lesser extent. Because the effectiveness of alternative C in eradicating or controlling weed establishment and spread is expected to be less than with alternatives that use herbicides, this alternative would not realize the same level of benefit as quickly. The risk to livestock from ingesting poisonous weeds from this alternative would be less than in the no-action alternative, but more than in alternatives B or D for the reason stated above.

Effects of Treatments on Livestock

No effects from treatments to livestock are expected to occur, because the project design includes working with livestock permittees as to the treatment schedule. It is anticipated that permittees would manage their livestock so as to avoid potential effects.

Effects of Livestock on the Spread of Weeds

There would be no change from what is described in the affected environment because this project does not propose to alter grazing practices.

Cumulative Effects

Effects of Weeds on Livestock

The direct and indirect effect of all the alternatives on the availability of forage is negligible; at present, weeds compose 2 percent or less of most of the allotments. Because the effect of the alternatives is negligible (immeasurable), there would be no cumulative effects.

Effects of Treatments on Livestock

Since there would be no direct or indirect effects to livestock from treatments due to the design of the project, there would be no cumulative effects.

Effects of Livestock on the Spread of Weeds

There would be no change from what is described in the affected environment because this project does not propose to alter grazing practices. Thus, there would be no cumulative effects.

Effects of Forest Plan Amendment to Livestock Grazing

The proposed plan amendment would have no effect on livestock grazing in the future because the restrictions imposed for herbicide use would not alter or affect grazing practices. Any effects from herbicide treatments in the future with the amendment in place would have the same effects as described in this section.

Social-Economic Resources

[Replaces entire section]

Issues Analyzed

From the comments made during scoping and notice and comment, the interdisciplinary team identified the following social issues to analyze in detail.

1. The proposed action may have a disproportionately high and adverse impact on the health of minority or low-income populations. This type of analysis is called “environmental justice” (Office of the President 1994). This issue did not result in the creation of a new alternative.
2. Weed treatment activities have the potential to affect human health and safety in a number of ways, including exposure to machinery, equipment, or chemicals. Although exposure to machinery and equipment poses a safety risk, the larger public concern relates to the health risk posed by using herbicides. This risk is defined three ways:
    a. By direct exposure during application.
    b. By contact with vegetation that has been sprayed and then collected for use.
    c. By direct or indirect exposure for people with heightened chemical sensitivities.[9]

    This issue resulted in the development of alternative C, which does not include herbicide use.

[9] Refer to page 33 of the FEIS for the complete wording of this issue.

3. On weed infestation sites where nonchemical methods are proposed for use without supplemental herbicides, weed control effectiveness would be lower and treatment costs higher.[10] This issue did not result in the creation of a new alternative.

Analysis Area

The analysis area for this project includes the eight counties within which the Carson and Santa Fe National Forests are located: Colfax, Los Alamos, Mora, Rio Arriba, San Miguel, Sandoval, Santa Fe, and Taos Counties. The people living in these counties are the most likely to be affected by the project.

Affected Environment for Low Income and Minority Populations

The issue analyzed here is: "the proposed action may have a disproportionately high and adverse impact on the health of minority or low-income populations."

Measure

The measure is quantification of minority and low-income populations in the study area and comparison of potential impacts to health and the environment.

Rationale

Executive Order 12898 requires all Federal agencies to analyze, and if necessary, address high and adverse human health or environmental effects of their actions and policies to minority and low-income populations.

Assumptions

- A population is considered a minority population if (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (Council on Environmental Quality (CEQ) 1997).
- Minority populations and low-income groups are identified at the county level because this unit of measure does not artificially dilute or inflate the affected minority population, pursuant to the 1997 guidance provided by CEQ.
- Low-income populations are identified using the annual statistical poverty thresholds from the 2010 census. The Census Bureau shows this data as a percent of the total population at different scales, shown below at the State and county levels.
- This analysis addresses the risks from exposure to herbicides of the general public. People employed by the Forest Service to treat weeds would be required to follow all safety regulations and the mitigations listed in table S-10 and table S-11. Following these precautions would reduce the risk to workers to a negligible amount.

[10] Refer to page 34 of the FEIS for the complete wording of this issue.

Methods

Minority and low-income populations within the project area were identified using 2010 census data at the individual county levels. Tribes were included with the census bureau's data on the counties.

Results

The 2012 population of the study area is estimated to be 420,038 people. Table S-62 shows the percentages broken down by ethnicity and race.

Table S-62. Ethnicity and race at the county scale (all figures are percentages)

	Ethnicity		Race		
Area	**Hispanic**	**Non-Hispanic**	**Native American**	**White**	**All other races**
Colfax County	48.2	48.6	2.3	94.3	3.4
Los Alamos County	15.6	75.0	1.0	89.7	9.3
Mora County	80.6*	18.1	2.9	94.2	2.8
Rio Arriba County	71.3*	13.3	18.0*	78.5	3.5
Sandoval County	36.3	46.6	13.4*	79.6	7.1
Santa Fe County	50.9*	43.7	3.9	91.4	4.7
San Miguel County	76.9*	19.6	2.8	92.4	4.8
Taos County	56.2*	36.1	7.2	88.4	4.4

* These represent minority populations according to the CEQ guidance.

Based on the information above, several racial and ethnic minority populations exist within the analysis area. These are:

- The Hispanic populations in Mora, Rio Arriba, Santa Fe, San Miguel, and Taos Counties
- The Native American population in Sandoval and Rio Arriba Counties

Table S-63. Percent of population below the Federal poverty level by county (all figures are percentages)

Area	Percent of population in poverty, 2007 - 2011
New Mexico	19.0
Colfax County	18.7
Los Alamos County	3.7
Mora County	16.3
Rio Arriba County	19.2*
Sandoval County	12.4
Santa Fe County	15.6
San Miguel County	26.2*
Taos County	21.5*

These represent low-income populations according to the CEQ guidance.

Those counties that show a greater percentage of the population below poverty than the state level are considered low-income populations. Based on the 2010 census data, low-income populations exist in the analysis area in Rio Arriba, San Miguel, and Taos Counties.

People from rural communities use the two national forests for recreation, traditional purposes, livestock grazing, fuelwood collection, and other activities. Fuelwood is essential to many residents in the area. Commercial and individual use of posts, poles and vigas is extensive. The majority of permittees grazing livestock on the two national forests are residents of the small Hispanic or Native American communities. The national forests contribute substantial employment in these communities through firefighting, timber crews, and rangeland work. Native Americans and Hispanics, in particular, gather plants, animals, wood products, and clay on the two national forests for religious purposes.

Most rural communities in the area rely on the Carson and Santa Fe National Forests to augment their incomes or for self-sufficiency. Special forest products and small commercial ventures contribute toward household livelihoods in northern New Mexico. These communities have established a cultural value of stewardship through many generations of interactions with the natural resources in the area. Quite often it is imperative for these residents to have a hands-on relationship with the forest that has sustained them for generations, as it is part of their cultural identity. These communities maintain a certain degree of self-sufficiency by meeting many of their own needs through self, family and friends. Sustainability of the land and its resources is a common need.

The primary influences on the local economy are recreation and tourism (service sector), and agriculture (ranching, small produce farming and miscellaneous forest products). Many of the residents commute to larger commercial centers for employment opportunities in manufacturing, construction, retail and government sectors.

Environmental Consequences to Low Income and Minority Populations

Direct and Indirect Effects to Human Health

When determining whether human health effects are disproportionately high or adverse, the CEQ instructs agencies to consider the following three factors to the extent practicable (CEQ 1997):

> (a) Whether the health effects, which may be measured in risks and rates, are significant (as employed by NEPA), or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death; and
>
> (b) Whether the risk or rate of hazard exposure by a minority population, low-income population, or Indian tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and
>
> (c) Whether health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

Alternative A

Under the no-action alternative, no weed treatments would occur; thus, there would be no human health effects to any population in the analysis area.

Alternatives B and D

There would not be a disproportionately high and adverse effect on minority or low-income populations under these alternatives. Because of the design features listed in table S-11 when using herbicides, the risks of exposure to the general public would be negligible. The minority and low-income populations, being tied to the land and tending to use the land for economic benefit and subsistence uses, could have a higher rate of exposure than the general population. An actual exposure to hazardous chemicals, however, is highly unlikely because of the design features listed in table S-11.

For example:

- The Forest Service will provide public information about using herbicides, including the herbicide to be used, locations, and application schedules using signs, public notices and other means.
- Treatments will be coordinated with range allotment permittees.
- In areas used by people (human habitation, recreational sites, traditional plant collections), only herbicides rated as having the lowest risk of harmful effects to humans would be allowed.

Alternative C

There would not be a disproportionately high and adverse effect on minority or low-income populations under this alternative because no herbicides would be used.

Cumulative Effects to Low-Income and Minority Populations

None of the alternatives would cause a disproportionately high and adverse effect on minority or low-income populations; therefore, there would be no cumulative effects.

Affected Environment for Human Health and Safety

The issue analyzed here is: “Weed treatment activities have the potential to affect human health and safety in a number of ways, including exposure to machinery, equipment, or chemicals. Although exposure to machinery and equipment poses a safety risk, the larger public concern relates to the health risk posed by using herbicides. This risk is defined three ways:

1. By direct exposure during application.
2. By contact with vegetation that has been sprayed and then collected for use.
3. By direct or indirect exposure for people with heightened chemical sensitivities.”

Measures

- Risk of exposure by application method
- Potential length of exposure
- Potential routes of exposure

- Toxicity of herbicides proposed for use

Rationale

Inherent to having confidence in the conclusions in this section is an understanding of what a reference dose is, how safe it is, and how it is determined. The U.S. Environmental Protection Agency (EPA) develops reference doses for chemicals, including the herbicides proposed for use by the Forest Service. A reference dose is defined by the EPA (1989) as an estimate of a daily dose over a 70-year life span that a human can receive without an appreciable risk of deleterious effects. A reference dose is determined by subjecting animals to substances and determining the lowest observable effect level (LOEL) and the no observable effect level (NOEL) from the entire body of scientifically supportable studies performed for that substance. The no observable effect level represents the dose the EPA believes would not result in an effect. Reference doses are calculated by dividing the no observable effect level, a level or dose already thought to not cause an effect, by a safety factor, usually 100, to account for extrapolation of animal data to humans and sensitive individuals. Therefore, the reference dose for a chemical is a dose at least 100 times lower than that shown to have an effect in any animal study performed with the subject chemical.

Toxicological studies using animals typically involve a purposeful exposure to dosages high enough to cause an effect. The causal dose in toxicological studies is significantly greater than what a worker would be exposed to while applying herbicides or what the public may be exposed to walking through a treated field or living adjacent to treated land. Herbicide applicators and the general public are clothed and do not purposely ingest herbicides under the same conditions as animals in studies of toxicological significance.

Assumptions

- Workers applying herbicides are at a higher risk of exposure than the general public because they will be in more regular contact with herbicides. The maximum duration of exposure for workers on a yearly basis was estimated in the range of 10 to 40 days for commercial applicators (U.S. EPA 1995). This is far less than that used to establish reference doses, which assumes a daily exposure for 70 years.
- Workers will follow the instructions, application rates, and safety precautions on the labels of the herbicide.
- The public will avoid areas being treated with herbicides due to the Forest Service’s notification procedures (table S-10 and table S-11), such as signs and posting on the Web site.
- Safe re-entry in areas where herbicides have been applied is when the herbicide has dried on the leaf surface.
- The mitigations built into the project will prevent people from ingesting herbicides (table S-11, rows 2, 10-14, 54-55, 58).
- Chemically-sensitive individuals are generally aware of their sensitivities and would not be allowed to work on herbicide crews. They would not enter treated areas until either safe re-entry periods, or a period they feel is adequate based on their personal knowledge of their sensitivity, has passed.
    - ♦ A small percentage of the population has a hypersensitivity to a wide variety of chemicals, including perfumes, household cleaners, construction products, industrial chemicals, and the herbicides proposed for use in this project (Gibson 2000, Barrett and

Gots 1998). A 1997 New Mexico Behavioral Risk Factor Survey completed by the New Mexico Department of Health's Office of Epidemiology indicates 2 to 3 percent of those responding to the survey instrument are chemically sensitive with up to 16 per cent of the New Mexico population possibly sensitive (Vorhees 1997).

♦ It is unknown what percent of this population frequents the national forests.

Methods

For a negative effect to human health to occur from an herbicide, a person must be exposed to it. The risk of exposure from herbicides was analyzed by reviewing the following scientific literature:

- "The Risk Assessment for Herbicide Use in Forest Service Regions (RAHUFS) 1, 2, 3, 4 and 10 and on Bonneville Power Administration Sites" (USDA Forest Service 1992). This analysis was developed for the Forest Service specifically to address human health issues raised by the use of herbicides.
- "Assessing the Safety of Herbicides for Vegetation Management in the Missoula Valley Region: A Question and Answer Guide to Human Health Issues" (Felsot 2001).
- Risk Assessments completed by the Forest Service under contract with Syracuse Environmental Research Associates for the chemicals proposed for use: 2,4-D, aminopyralid, picloram, clopyralid, dicamba, hexazinone, sulfometuron methyl, metsulfuron methyl, triclopyr, imazapic, and imazapyr (USDA Forest Service 1995d, 1996c, 1996d, 1997c, 1998b, 1998c, 1999b-d, 2002, 2001; SERA 2002-2007).

The risk assessments consist of three things: (1) a review of toxicity test data (acute, chronic, and subchronic) for the herbicides to determine dosage that could pose a risk to human health; (2) an estimate of exposure levels to which workers and the general public could be exposed during treatment operations; and (3) comparison of dose levels to toxicological thresholds developed by the EPA to determine potential health risks.

The Forest Service has developed additional protection measures, found in table S-10 and table S-11, to further reduce the risk of exposure. The end result is that the Forest Service's application of herbicides exceeds the safety requirements and mitigations that are required by EPA.

Results

Method of Application

The risk assessments compared risks of exposure to workers from backpack, ground-mechanical, and hand application.

The "drift" that can occur when spraying herbicides is a way that people can become unintentionally exposed. Spray drift is when the herbicide is picked up by wind after leaving the nozzle and carried away from the intended treatment area. Spray drift is primarily a function of droplet size, release height, and wind speed (Teske and Thistle 1999).

Wind speed increases the number of droplets leaving the treated area if the wind is blowing away from the release point. If the wind is favorable (blowing into the treatment area) drift is reduced. Numerous studies have shown that over 90 percent of droplets land in the target area, 10 percent or less move off-target, and the droplets that move off-target most typically deposit within 100 feet of the target area (Felsot 2001, Yates et al. 1978, Robinson and Fox 1978, Teske and Thistle 1999).

Length of Exposure

The magnitude of a hazardous dose comes in three forms: (1) a single dose occurring at once (acute exposure); (2) multiple doses over longer periods (chronic exposure); or, (3) regularly repeated doses over periods ranging from several days to months (subchronic). As described in the "Rationale" section, the EPA describes exposure in terms of reference doses to determine potential hazards of herbicides to humans.

The reference dose for each herbicide in this project serves as a conservative toxicological threshold for two reasons. First, the reference dose assumes daily exposure over 70 years. Second, the reference dose is calculated from the no observed effect level (NOEL) that assumes humans are 100 times more sensitive than animals.

Route of Exposure

Ingestion

Another measure for toxicity is LD_{50} (where LD stands for "lethal dose"). LD_{50} measurement levels exist for oral, dermal, and inhalation exposure. LD_{50} is the dose that kills 50 percent of a test population, measured in one milligram of herbicide per kilogram of animal weight (U.S. EPA 1996a, 1996b). To arrive at LD_{50s} in a laboratory setting, high doses of herbicides are given to animals orally, dermally, or by inhalation (U.S. EPA 1996c). These doses are much higher, by orders of magnitude, than any worker or member of the public would be exposed to during this project. Ingestion is the least likely route of exposure; the design features discouraging people (table S-11, rows 2, 10-14, 54-55, 58) from going into areas while an herbicide is still wet means that the public will have no chance of exposure, even if collecting plants. Since people are not likely to ingest herbicides, there will be no effect from ingestion. Therefore, this route of exposure will not be discussed further.

Dermal Absorption

Studies show that human skin acts as a protective barrier that limits the amount of a chemical that passes into the body; only about 10 percent or less of the chemical passes through the skin to the bloodstream. In contrast, absorption of chemicals from the small intestine (oral ingestion) is quicker and more complete than from the skin (Ross et al. 2000). For this reason, a dermal LD_{50} is usually much higher than an oral LD_{50}. This means that a person can tolerate greater doses of a substance without becoming sick when exposure is through skin contact rather than through ingestion (Hayes 1991).

Inhalation

Inhalation of chemicals causes illness more quickly than by oral or dermal contact due to the rapid entry of the substance into the blood stream. Studies of pesticide applicators, however, show that dermal exposures are greater than inhalation exposures (Ross et al. 2000).

Toxicity of Herbicides

A comparison of toxicity for the herbicides proposed for use is shown in table S-64.

Endocrine Disruption

Chemicals can interact with components of the endocrine system. Scientists have discovered that many kinds of chemicals, including natural food biochemicals as well as industrial chemicals and a few pesticides, can mimic the action of the hormones estrogen or testosterone. Concern has also been expressed about potential effects on the thyroid hormone during early development (Felsot 2001).

Environmental Consequences to Human Health and Safety

Note that the effects from prescribed burning are analyzed in the “Air Quality” section of this report.

Direct and Indirect Effects of Alternative A

There would be no impacts to human health and safety from any proposed treatment because treatments would not occur.

The effect of continued weed spread on human health, such as allergies, would remain; however, this effect is likely very small given the size of the weed populations in relation to the project area. Known weed populations occupy approximately 0.5 percent of the 3 million acres in the project area. People suffering from allergies are far more likely to be affected by juniper pollen, for example, since juniper trees are common in the forests.

Table S-64. Comparison of the toxicity of herbicides proposed for use

Herbicide	Carcino -genic[1]	Estimated Exposure to Public[2]	Estimated Exposure to Worker[2]	Reference Dose (mg/kg/day)	Mutagenic and Reproductive[3]	Acute oral LD_{50} for rats (mg/kg/day)
Aminopyralid	E	< RfD	< RfD	0.5	No	> 5,000
2,4-D	D	< RfD	< RfD[8]	0.01	No	100 - 1,800
Chlorsulfuron	E	< RfD	< RfD	0.05	No	> 5,000
Clopyralid	E	< RfD	< RfD	0.5	No	2,675 - 5,000
Dicamba	D	< RfD	< RfD	0.03	No	757 - 1,701
Glyphosate	E	< RfD	< RfD	0.1	No	2,000-6,000
Hexazinone	D	< RfD	below to slightly above RfD[7]	0.03/0.05[4]	No	1,690
Imazapic	E	< RfD	< RfD	0.05	No	5,000
Imazapyr	E	< RfD	< RfD	2.5[5]	No	> 5,000
Metsulfuron methyl	E	< RfD	< RfD	0.25	No to slight	> 5,000
Picloram	E	< RfD	< RfD[6]	0.2	No	3,000-5,000
Sulfometuron methyl	E	< RfD	< RfD	0.02[5]	No	> 5,000
Triclopyr	E	< RfD	< RfD	0.005	No to slight	630 - 729

RfD = Reference Dose; units expressed as milligrams of herbicide per kilogram of body weight

LD50 = lethal dose in milligrams of herbicide per kilogram of body weight

1. EPA carcinogenicity classification based on daily consumption for 70 years. D = Not classifiable as to human carcinogenicity; E = Evidence of noncarcinogenicity

2. Exposures under typical exposure scenarios. Accidental and extreme exposure scenarios may exceed the reference dose.

3. Unlikely that compound is mutagenic or would pose a mutagenic risk to humans at expected exposure levels.
4. Two reference doses reported.
5. Provisional reference dose, EPA has not derived a reference dose for this compound.
6. USFS (1999b) reports that workers wearing contaminated glove may receive an absorbed dose greater than the reference dose. The design features in Chapter 2 would prevent this scenario from occurring.
7. USDA Forest Service (1997a) reports that over a range of plausible application rates, workers may be exposed to hexazinone at levels that exceed the reference dose.
8. USDA Forest Service (1998) reports that workers involved in ground application of 2,4-D may be exposed to levels above the reference dose if effective methods to protect workers and minimize exposure are not employed. The design features in chapter 2 would prevent this scenario from occurring.

Nonetheless, approximately 10 to 15 percent of the United States population suffers from allergy symptoms from weed species such as knapweed. Knapweed pollen is a common and powerful allergen that peaks in August and produces strong allergy symptoms. Knapweed pollen has been implicated in causing allergic rhinitis (Gillespie and Hedstrom 1979). Allergies to airborne seeds may also complicate or trigger asthma that may take up to 2 years to get completely under control.

Cumulative Effects of Alternative A

The effect on human health under this alternative is aggravated allergies. This risk is considered too small to be measurable; thus, there would be no cumulative effects from the no-action alternative.

Direct and Indirect Effects of Alternatives B and C

Biological Treatments

Biological treatments would result in no known risks to human health because the biological control method is designed to target specific plants. No health effects to people have been documented from this method.

Controlled Grazing

Controlled grazing would result in no known risks to human health and safety. Humans have grazed livestock in the national forests for over 100 years without any documented, significant health effects.

Manual Treatments

Risks to worker's health from manual methods are considered minor. The use of personal protective equipment like gloves, long sleeved shirts, and boots would prevent most skin irritations (such as cuts or blisters) from occurring. Rarer conditions can be triggered; for example, leafy spurge contains a latex-bearing sap that irritates human skin and rarely but may cause blindness in humans upon contact with the eye (Callihan et al. 1991). There have also been claims (not medically supported) that hand pulling of knapweed may result in the formation of tumors on the hands. The risk of injury from repetitive motion and back and knee strain exists, but would be no greater than any other physical labor normally performed by Forest Service employees. Workers with allergies to weeds would suffer the most from this method.

Because the public would not be treating weeds, there would be no effects from manual methods.

Mechanical Treatments

Potential risks to human health from mechanical weed control methods are considered low. Mechanical methods, such as mowing or root tilling, are commonly used throughout the world. As a result, the mitigations to lesson risk (such as wearing hard hats, safety glasses, and ear protection) are well established and proven to work. A risk of physical injury due to accidents exists.

Because the public would not be treating weeds and would not be permitted entry when heavy equipment is operating, there would be no effects from mechanical methods.

Direct and Indirect Effects of Alternatives B and D

Herbicides

Method of Application

Since the public will not be applying herbicides, their risk of exposure by any application method proposed in this project is zero.

Following the design features requiring the use of protective equipment, application rates, and the weather conditions means that a worker’s risk of exposure to herbicides would be negligible. The risk assessments prepared for this project show that ground-mechanical application resulted in a lower risk of exposure than other methods, even though the total amount of herbicide applied in a given day was higher. Risks from backpack and hand application have the highest risk of exposure because workers are closer to the nozzle and to the containers from which the herbicides are sprayed. Backpack and hand application were also reported to increase the likelihood of a worker receiving repeated exposures that may remain on the worker's skin for an extended time period. Training in the application of herbicides will minimize this risk.

Drift – Because the public would stay out of or be restricted from entering areas during herbicide application, no exposure to spray drift would occur. Further, the RAHUFS spray drift analysis (see page 158) shows that the risk of exposure to the public from ground methods is low (USDA Forest Service 1992). The study defines “low risk” as less than one in a million chance of developing systemic problems, reproductive problems, or cancer.

The risk of exposure to workers from drift would be less than EPA’s reference dose. Felsot (2001) used a model called AGDRIFT I to simulate herbicide sprays for several scenarios, including a truck mounted spray boom set at two heights. His study showed that a child (who would be more susceptible to harm because of having lower body weight) standing 27 feet from the sprayed edge would not exceed the EPA’s reference dose.

Length of Exposure

Acute Toxicity – The exposure to the public or workers to herbicides would be far less than the EPA’s reference dose. Whereas the reference dose assumes a daily exposure for 70 years, workers (who would have more exposure than the public) would be exposed 10 to 40 days per year. Thus, the risk of acute exposure is zero for either workers or the general public. This conclusion is supported by various studies estimating the exposure to workers and the public under scenarios more conservative that what would actually occur in this project (USDA Forest Service 1995; 1996a; 1997a-c; 1998; 1998d; 1999c; 1999d; 2000; 2001). The most reasonable interpretation of the risks associated with application of herbicides on national forest lands is that, except for accidental exposures or extremely atypical or implausible scenarios (i.e., acute direct spray entirely covering a naked child), the use of herbicides on national forest lands would not pose an identifiable risk to workers or the general public.

Subchronic and Chronic Toxicity – The likelihood of chronic or subchronic exposure to the public to herbicides is zero, based on the assumption that the public would avoid or be restricted from entering places where herbicides are being applied. The likelihood of a member of the public being repeatedly exposed to herbicides above the reference dose is nearly zero.

Workers, who are expected to apply herbicides for 10 to 40 days per year for up to 10 years, would still have an exposure less than the EPA's reference dose (daily exposure for 70 years). The mitigations built into this project would further reduce a worker's risk of exposure. As noted in table S-64, two exceptions exist. A Forest Service research project (1997d) reports that over a range of plausible application rates, workers may be exposed to hexazinone at levels that exceed the reference dose. Likewise, there is reasonable concern that workers applying triclopyr over a prolonged period of time in the course of a single season and/or several seasons may be at risk of impaired kidney function (USDA Forest Service 1996d).

Route of Exposure

Dermal Absorption – The likelihood of a member of the public absorbing an herbicide through their skin is virtually zero. The mitigations are designed to inform the public of treatments, or restrict them from entering treated areas until the herbicide is absorbed by the plant. The likelihood of a member of the public being repeatedly exposed to herbicides through their skin above the reference dose is nearly zero.

Required personal protective equipment used by workers during pesticide application (gloves, waterproof boots etc.) is designed to reduce exposure to sensitive areas on the body. Use of personal protective equipment is required by the Forest Service and would reduce the chance of dermal absorption. The use of personal protective equipment, combined with the fact that workers would be exposed only 10 to 40 days per year, means that a worker's exposure would be less than the LD_{50}.

Inhalation – Studies show that the risk of dermal exposure is higher than the risk of inhalation. Since the risk of dermal exposure is below the LD_{50}, the risk of inhalation would be as well.

Toxicity of Herbicides

Controlled studies suggest that the herbicides proposed for use by the Forest Service are not carcinogenic. Further, no evidence exists showing that the herbicides proposed for use would result in carcinogenic, mutagenic, teratogenic, neurological or reproductive effects based on anticipated exposure levels to workers and the public (Arbuckle 1999; Charles et al. 1996; Paustini 1996; Ibrahim, et al. 1991; Mattsson 1997; Mustonen 1986; Infoventures 1995a-j; OSU 1996a-h; U.S. EPA 1990 and 1990a; USDA Forest Service 1995, 1996a, 1997a, 1997c, 1998, 1998d, 1999c-d, 2000, 2001, 2001b; SERA 2002 - 2007).

Further, with respect to herbicides proposed in this project, it has been estimated in nearly all cases that the dose a worker or a person from the public would be exposed to would be below the reference dose.

This conclusion excepts accidental spills and implausible exposure scenarios (spray over entire naked body or wearing heavily contaminated gloves for an extended period).

Synergistic Interactions – Concerns are occasionally raised about potential synergistic interactions of herbicides with other herbicides in the environment or when they are mixed during application. No one can guarantee the absence of a synergistic interaction between herbicides and/or other chemicals to which workers or the public might be exposed. For example, exposure to benzene, a known carcinogen that comprises 1 to 5 percent of automobile fuel and 2.5 percent of automobile exhaust, followed by exposure to any of these herbicides could result in unexpected biochemical interactions (USDA Forest Service 1997b). Analysis of the infinite number of materials a person may ingest or be exposed to in combination with the herbicides proposed here is outside the scope of this analysis; however, because the risk of exposure to the public is nearly zero to begin with, the chance of a synergistic interaction from this project is also very low.

Impurities and Inert Ingredients in Herbicide Formulations – During commercial synthesis of some pesticides, byproducts can be produced and carryover into the product eventually formulated for sale. Occasionally byproducts or impurities are considered toxicologically hazardous, and their concentrations must be limited so that potential exposures do not exceed levels of concern (Felsot 2001). The byproducts raised as points of concern are HCB (hexachlorobenzene), dioxins (especially TCDD), inert ingredients, dyes, and surfactants. The effects of each are summarized here; a more detailed examination exists in the project record.

HCB (Hexachlorobenzene)

The use of clopyralid or picloram in accordance with the label would not result in increases in the general exposure of either workers or members of the general public to HCB. The central estimates of worker exposure to HCB under normal conditions were estimated to be lower than the background levels of exposure by factors of about 1,000.

Dioxins (especially TCDD)

Current quality control procedures during manufacturing have essentially eliminated any dioxin congeners of concern from domestic 2,4-D formulations. Thus, use of 2,4-D products manufactured in the United States, whether at home or in the national forests, do not contaminate the environment with the dioxin congener of greatest regulatory concern, TCDD (U.S. EPA 2000, chapter 8 of the Draft Dioxin Assessment).

Inert Ingredients

The proprietary nature of herbicide formulations limits the understanding of the risks posed by inert ingredients in herbicide formulations. Studies on the toxicity of technical grade formulations, which often contain the inert ingredients, account for the toxicity of the inert ingredients, and as has been reported here, these studies show that the use of herbicides by the Forest Service would not expose workers or the public to levels of concern.

Dyes

Limited information is available on the toxicity of the majority of dyes used in the industry. There has been considerable concern over the carcinogenic potential of less used dyes Rhodamine B and Basic Violet 3. The Forest Service completed a risk assessment of Rhodamine B and Basic Violet 3. It estimated the excess cancer risk for Rhodamine B, assuming a lifetime of occupational exposure, was extremely low (USDA Forest Service

1997e). The excess cancer risk for Basic Violet 3 was estimated to be about twice that of Rhodamine B. Both estimates suggest that use of these dyes does not pose an unacceptable health risk.

Surfactants

Like dyes and other inert ingredients, there is often limited information on the types of surfactants used and the toxicity of surfactants, especially since the industry considers the surfactant to play a key role in the effectiveness of the herbicide formulations. Most knowledge of surfactants is kept as proprietary information and not disclosed. This is not always the case. The Forest Service (1997c), which attempted to assess the effects of surfactant formulations on the toxicity of glyphosate, reported that the toxicity of glyphosate alone was about the same as the toxicity of the glyphosate and surfactant mixed and greater than the toxicity of the surfactants alone. Whether this same pattern would hold true of other herbicides having the same or different surfactants is unknown. If so, the toxicological studies performed on herbicide formulations (which contain the inert ingredients and surfactants) may accurately portray the toxicity and risks posed to humans by the surfactant.

Endocrine Disruption

In the live animal studies to date, only a handful of chemicals, including natural food biochemicals, a few pesticides, and several industrial chemicals show endocrine disrupting effects (Felsot 2001). With one exception, the drug DES, any effects that have been observed were in tests with doses at least thousands of times greater than environmental or dietary concentrations.

In virtually all published cases where a series of doses are tested, endocrine effects did not occur below some threshold dose (U.S. EPA 1997a). The EPA (1997a) concluded, with few exceptions (e.g., diethylstilbestrol), a causal relationship between exposure to a specific environmental agent and an adverse effect on human health via an endocrine disruption has not been established.

Uncertainty

With the exception of accidental exposures, workers and the general public would not be exposed to any herbicides at concentrations that result in an adverse health effects. This conclusion is predicated on Forest Service employees wearing appropriate personal protection, applying herbicides in accordance with the label, and implementing the job hazard analysis as prescribed for this project (chapter 2). By doing so, possible exposure by contact or through drift would result in a potential dose below that determined to be safe by the EPA over a lifetime of daily exposure. It is also predicated on the findings, backed by toxicological studies, that a person can be exposed to some amount of a contaminant and not have an adverse effect (i.e., the dose determines the effect).

Comparison of Alternatives B, C and D

Alternative C, which proposes no herbicide use, would have no effects to human health from herbicides. It would, however, have the highest risk of physical injury (such as slips, trips, strains, and falls). Nonetheless, the risk of physical injury is considered to be low, and no greater than from other Forest Service activities.

Alternative D would have the highest risk of accidental spills of herbicides, since herbicide use is the only method proposed. More time spent mixing and applying herbicides increases the risk of a spill. The public may be exposed to a spill should the herbicide reach surface or groundwater. The indirect effects of a spill would be commensurate with the proximity of the spill area to the public and public exposure pathways. In terms of effects to human health and safety from routine application of herbicides without spills, the discussion above shows that the risk is expected to be low, meaning it would be lower than the exposures shown by the EPA to cause health effects. We also recognize, in the discussion of uncertainty, that there cannot be a 100 percent guarantee of no effect.

Alternative B contains the same risks described in alternatives C and D.

Cumulative Effects of Alternatives B, C, and D

The spatial “boundary” of the effects considered here is an individual. The temporal boundary is from the start of this project for 10 years, anticipated to be from 2015 through 2025. This is the period of time during which the Forest Service anticipates having controlled or eliminated its known weed populations. Table S-65 displays the cumulative effects to human health and safety.

Table S-65. Cumulative effects to human health and safety

Method of treatment	Direct and indirect effects	Actions that cumulatively contribute to the direct and indirect effect	Cumulative effect
Biological	No measurable effect to workers or the public	Not applicable	Since there is no direct or indirect effect from biological methods to human health and safety, there would be no cumulative effect.
Controlled grazing	No measurable effect to workers or the public	Not applicable	Since there is no direct or indirect effect from grazing to human health and safety, there would be no cumulative effect.
Manual	Risk of slips, trips, sprains, and falls to workers.	Trail construction and maintenance Construction and reconstruction of facilities Suppression and rehabilitation of wildfires Hazardous fuels treatment Prescribed burning Other projects involving physical work	A cumulative effect to overall physical health (in terms of flexibility and soundness) is possible if the same workers conduct multiple projects, as is often the case with Forest Service employees.
Mechanical	Risk of physical injury, primarily due to accidents, to workers	Road construction and maintenance Trail construction and maintenance Construction and reconstruction of facilities Suppression and rehabilitation of wildfires Hazardous fuels treatment Prescribed burning Other projects involving physical work Other projects involving heavy equipment	Forest Service employees experiencing moderate or severe injuries due to accidents are put on “light duty” and would not continue with the physical activities until they were well. Thus, there would be no cumulative effects. A cumulative effect to overall physical health (in terms of flexibility and soundness) is possible if the same workers conduct multiple projects, as is often the case with Forest Service employees.
Herbicides			
Method of application	No effects to the public since they would not be applying herbicides. Risk of exposure to workers exists (dermal contact has the highest likelihood of resulting in exposure); however, it would be well below EPA’s reference dose.	Not applicable	Since there is no direct or indirect effect to the public, there would be no cumulative effects. The risk of an effect to health to a worker is small enough to be immeasurable; therefore, there would be no cumulative effects.

Method of treatment	Direct and indirect effects	Actions that cumulatively contribute to the direct and indirect effect	Cumulative effect
Length of exposure	The use of herbicides on forest lands would not pose an identifiable risk to workers or the general public, either for acute, sub-chronic, or chronic toxicity. In all cases the likely exposure would be far less than EPA's reference dose.	Not applicable	The risk of health effects to a worker or the public is small enough to be immeasurable; therefore, there would be no cumulative effects.
Route of exposure	The amount of dermal exposure expected for workers would be less than the LD_{50} and would be negligible. Inhalation would be even less. No risk of dermal exposure to the public. Very low risk of inhalation exposure for the public.	Not applicable	The risk of health effects to a worker or the public is small enough to be immeasurable; therefore, there would be no cumulative effects.
Toxicity of herbicides	Studies suggest that the herbicides proposed for use by the Forest Service are not carcinogenic and do not cause other health effects.	Not applicable	Since the herbicides themselves are not expected to cause health effects, there would be no cumulative effects.
Synergistic interactions	A risk of synergistic interactions that would cause negative effects to human health exists. Studies covering the effects of exposure to the infinite combinations of chemicals that exist in society do not exist.	There is no way to compile a complete list due to the sheer number of chemical that exist in society today. Examples are gasoline, household cleaning products, construction materials, cigarette smoke, etc.	A cumulative effect exists, but cannot be quantified due to the unknown exposures that an individual is subject to in their daily routine.
HCB	The use of clopyralid or picloram in accordance with the label would not result in increases in the general exposure of either workers or members of the general public to HCB.	Not applicable	Since there would be no increase in exposure to HCB, there would be no direct or indirect effect to human health; thus, there would be no cumulative effects.

Method of treatment	Direct and indirect effects	Actions that cumulatively contribute to the direct and indirect effect	Cumulative effect
TCDD	The use of 2,4-D products manufactured in the United States do not contaminate the environment with TCDD. Thus, there would be no human exposure to TCDD from this project.	Not applicable	Since there would be no direct or indirect effects to human health from TCDD, there would be no cumulative effects.
Inert ingredients	Studies on the toxicity of technical grade formulations, which often contain the inert ingredients, account for the toxicity of the inert ingredients, and these studies show that the use of herbicides by the Forest Service would not expose workers or the public to levels of concern.	Not applicable	Since there would be no direct or indirect effects to human health from the inert ingredients contained in the herbicides proposed for use in this project, there would be no cumulative effects.
Dyes	Use of dyes does not pose an unacceptable health risk in the context of this project, which would not entail a lifetime of application.	Not applicable	Since there would be no direct or indirect effects to human health from the dyes contained in the herbicides proposed for use in this project, there would be no cumulative effects.
Surfactants	A risk to human health may exist from the surfactants contained in herbicides, but this risk has not been studied and quantified. Most information on surfactants is proprietary and not disclosed.	There is no way to compile a complete list of products that contain surfactants to which an individual would be exposed during the same timeframe of this analysis. Too many of them exist, and it is not possible to identify the daily habits and exposures of the workers	A cumulative effect exists, but cannot be quantified due to the unknown exposures that an individual is subject to in their daily routine.
Endocrine disruption	No causal relationship between exposure to a specific herbicide and an adverse effect the endocrine system has been established.	Not applicable	Since there would be no direct or indirect effects to the endocrine system from the herbicides proposed for use in this project, there would be no cumulative effects.

Cost-Benefit Analysis

The issue analyzed in this section is: "On weed infestation sites where nonchemical methods are proposed for use without supplemental herbicides, weed control effectiveness would be lower and treatment costs higher."

Measure

Economic efficiency is measured in present net value.

Rationale

Present net value is a common and widely accepted measure of economic efficiency for all kinds of projects.

Assumptions

- This is not an exhaustive economic determination, but rather an estimate of economic efficiency. Some values are unknown, others are difficult to determine, and still others are dependent on the quality of the data provided.
- Estimates from employees are used for local costs such as fence building.
- The workforce used to treat weeds, either contracted or Forest Service employees, would not exceed 30 individuals on a part time or temporary basis.
- Only costs and benefits contained in published Forest Service documents that relate directly to this project are included.
- Sunk costs are not part of the analysis.
- Nonmarket or indirect values such detoxification and decomposition of toxic waste or potential property value changes are not used in the Quicksilver economic estimations (State of the Southern Rockies - San Juan-Sangre de Cristo Bioregion, 1998).

Methods

Quicksilver, a public domain computer program, was used to model the economic efficiency of the alternatives. This program estimates present net value based on costs and benefits of the treatments contained in each alternative.

Results

Present net value shows whether an investment will be profitable. It measures present cash outflow to projected inflows over the life of the project. For this analysis, it is used to show the relative benefit among alternatives, not their exact cost. The project record contains the estimated costs of various treatments used in the model.

In business, a negative value means that a project would not go forward because it would lose money, and that the result for the money spent would not be economical. This concept does not completely apply to forest management, because there is no projected cash inflow as a result of doing the project. However, using present net value shows the relative cost of the alternatives.

Alternative A (no action) has a negative value because Forest Service staff will continue to monitor known and new weed populations. An additional cost associated with the no-action alternative (not included in the present net value calculation) is that of performing NEPA analyses to treat individual weed infestations. The other three alternatives, B, C, and D, include the cost of treating and monitoring known and new weed infestations over time.

Table S-66. Present net value (rounded to nearest dollar) of the alternatives

Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (No Herbicides)	Alternative D (Herbicides Only)
-4,324	-99,325	-92,956	36,963

Source: Quicksilver analysis

Alternative D appears to be the most cost effective because the use of herbicides has been demonstrated to be more effective at controlling and eliminating weeds than other methods, so fewer treatments would be required. Using herbicides would also require fewer personnel.

The proposed action appears to be the most expensive because it encompasses all the methods of treatment. The present net values show that nonherbicidal methods are likely to cost more than herbicides. Frid et al. (2013) found that strategies that prioritize targeting small, new infestations consistently outperform strategies that target large, established patches.

Effects of Forest Plan Amendment to Social and Economic Resources

The proposed plan amendment limits herbicide use to “when determined through an environmental analysis to have no long-term adverse environmental, economic or social impacts.” This modified language would be more clearly and consistently interpreted than the vague original language. The modified language would also provide for greater consistency with environmental analysis requirements under NEPA, which is appropriately based on estimated impacts rather than on the “acceptability” of a proposed action.

Environmental Justice

The proposed plan amendment would have no effect on environmental justice in future projects. The amendment would allow chemical treatments “when determined through an environmental analysis to have no adverse environmental, economic, or social impacts for longer than 6 months.” First, this restriction applies to all areas equally and does not favor any specific group. Second, an analysis of environmental justice would be applied for individual projects. The design features and mitigations listed in the amendment would protect low-income and minority populations during herbicide use in future projects.

Human Health and Safety

The design features listed in the amendment would protect people during herbicide use in future projects.

Cost/Benefit

The proposed plan amendment is likely to increase the cost of future projects that use herbicides by requiring an analysis of effects up to 6 months, and monitoring for whether soils are within the standards listed.

Consistency with Forest Plan, Laws, and Policies

[New paragraph]

All alternatives are consistent with EPA, OSHA, and Forest Service regulations for herbicide use and worker safety. An amendment to the Santa Fe National Forest Plan has been proposed; otherwise, this project is consistent with the Carson and Santa Fe Nation Forest Plans.

Other Required Disclosures

Short-term Uses and Long-term Productivity

[No change from FEIS]

Unavoidable Adverse Effects

[No change from FEIS]

Irreversible and Irretrievable Commitments of Resources

[No change from FEIS]

Incomplete or Unavailable Information

[New section]

All of the herbicides proposed for use by the Forest Service must be registered for use by the EPA and the New Mexico Department of Agriculture. Registration of these herbicides and Federal regulations adopted to protect workers and the general public have required more scientific information and justification for use of herbicides. Nevertheless, there are many reports in the scientific literature that document associations between herbicide exposure and alterations of the immune system, autoimmune disorders, and increases in the probability of carcinogenesis. Samsel (2013), MCCHB (2001), Citron (1995), EPA (1995) Glover-Kerkvliet (1995) are just a few references that provide information on such effects. The body of literature on herbicide effects raises concerns about additive and synergistic effects of exposure to more than one herbicide, unstudied or unknown consequences of low-level chronic exposures, toxicity of inert ingredients, by-products or contaminants of herbicides, and uncertainties about the health effects of sensitive populations. There is also the realization that it is difficult, if not impossible, for government or any scientific agency to fully evaluate a chemical and all the potential combinations of them to ensure that there would not be an adverse effect.

It would be inappropriate to suggest that use of herbicides to control weeds is without risk to workers and the general public. If herbicides are used, there is the possibility of worker and general public exposure, no matter how many design features are implemented. All chemical exposure results in some level of health risk, the risk primarily being a function of the dose, or amount a person or organism is exposed to over a period of time.

It is equally inappropriate to conclude that any exposure, regardless of dose, would result in an effect. It is easy to find a report showing a health effect caused by the exposure to an herbicide or any other chemical. The toxicological studies are purposely done using high doses to demonstrate an effect. It is the herbicides that show effects at low levels of exposure or those levels anticipated when in use that should raise concern. With respect to this project, the potential dose received by the worker or member of the public does not approach the exposure levels shown to cause acute, chronic, or subchronic toxicity in the literature. Acute effects occur at doses thousands to tens of thousands of times higher than those estimated for the worker or public for this project. Likewise, chronic effects reportedly occur at doses significantly higher than that expected for this project.

There are simply too many variables (receptor sensitivity, dose received, use of personal protection, and so forth) for anyone to predict with 100 percent certainty the potential health risk of herbicide use and exposure. What is known is that through a process of continual review of toxicological data on herbicides, the EPA, using very conservative assumptions, has determined a dose they believe would not result in an adverse health effect for herbicides proposed for use on this project. Some studies show that exposure to the herbicides proposed for use at high doses can cause deleterious effects. The risk assessments, however, have been completed to determine the estimated dose a worker or person of the general public might be exposed to under varying exposure scenarios. Most important, we know through a comparison of EPA-established safe doses and estimated exposures that the estimated dose that a worker or person of the general public may be exposed to through use of a herbicide on this project would be below that determined to be safe by the EPA for a lifetime of daily exposure. Therefore, no health effects or risks to workers and the general public are anticipated by the use of herbicides for this project.

Preparers and Contributors

[Revised section]

From 1999 to 2002, the Forest Service worked with a team of contractors to develop the first draft of the EIS. From 2003 to 2005, an expanded interdisciplinary team composed of Forest Service staff and contractors prepared the FEIS published in 2005. That team is listed on pages 185-186 of the 2005 FEIS. The following lists the Forest Service personnel who prepared this draft SEIS.

Name	Position	Contribution	Education and Experience
Julie Bain	Forest NEPA Coordinator, Santa Fe National Forest	Project leader, NEPA compliance, editor of Vegetation and Livestock Grazing sections, writer	MS Environmental Studies 18 years experience
Francisco Cortez	Carson National Forest Wildlife, Fish, Rare Plant Program Manager	Wildlife, fisheries and aquatic resources	BS Wildlife Biology 21 years of experience
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Timothy Downing	GIS Specialist, Santa Fe National Forest	GIS	MS Natural Resource Management 3 years experience
Michael Frazier	Staff Officer, Santa Fe National Forest	Recreation, wilderness, and visual resources	BA Liberal Arts BS Forestry 42 years experience
Michael Gatlin	Fisheries Biologist, Carson National Forest	Fish and aquatic resources	BS / MS, Fisheries and Aquatic Ecology and Management 5 years experience
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Judy York	Forest Service writer-editor TEAMS Enterprise Unit	Editing, publication layout	BS Wildlife Resources MS Natural Resources Communications 25 years experience

Distribution of the Draft SEIS

This draft supplemental environmental impact statement has been distributed to, or made electronically available to, over 200 individuals and groups who specifically requested a copy of the document or commented during public involvement opportunities. In addition, copies have been sent (or in some cases made electronically available) to Federal agencies, federally recognized tribes, State and local governments, and organizations that have requested to be involved in the development of this analysis. These entities include the U.S. Environmental Protection Agency; U.S. Army Corps of Engineers; U.S. Department of the Interior; Federal Highway Administration; Advisory Council on Historic Preservation; USDA National Agricultural Library; State wildlife and fisheries management agencies; tribes; county commissions; and local community governments. Due to the number of people, agencies, and organizations, a complete listing has been omitted from this EIS, but is available upon request.

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Appendix 1. Past, Present, and Future Weed Control Activities

[No change from FEIS]

Appendix 2. Weed Species Ecology and Impacts

[Remove Field Bindweed (*Convolvulus arvensis*) (COAR4)]

The abbreviation for saltcedar (*Tamarix spp.*) is TARA.

The abbreviation for Spotted Knapweed (*Centaurea biebersteinii*) is CESTM.

[Add the following three species]

Cheatgrass (*Bromus tectorum*) (BRTE)

This description comes from Utah State University[11].

Cheatgrass was introduced to North America through contaminated grain seed, straw packing material, and soil used as ballast in ships sailing from Eurasia. This first occurred between 1850 and the late 1890s. During this time, overgrazing coupled with drought left many Great Basin rangelands in poor condition. Cheatgrass was able to occupy areas where the native vegetation had been reduced, beginning its persistent march across the landscape. It can now be found across the landscape from the bottoms of desert valleys to mountain peaks as high as 13,000 feet. The plant communities most affected by cheatgrass invasion are those below 6,000 feet in elevation. These include piñon/juniper woodlands, sagebrush, and salt-desert shrub community types.

As a winter annual, cheatgrass seeds germinate at low fall temperatures. Seedling roots continue to grow throughout the winter, and by spring, are capable of out-competing native species for water and nutrients because most native vegetation is just getting started. Cheatgrass completes its life cycle quickly and can become dry by mid-June. Cheatgrass is a prolific seed producer, and large seedbanks can develop. It only takes a few plants in a sagebrush/perennial grass community to produce enough seeds to overwhelm native perennials in seedling-level competition.

[11] http://www.usu.edu/weeds/plant_species/weedspecies/cheatgrass.html

Fuller's Teasel (*Dipsacus fullonum*) (DIFU2)

This description is taken from southwestlearning.org and the USDA's Fire Effects Information system, accessed on December 12, 2013.

Fuller's teasel is a biennial plant that grows a two- to eight-foot flowering stem. The flowers are very small and packed into dense, cone-shaped heads. Once the plant has flowered, it becomes woody and persists through the winter. It is currently found in most of the 50 states. Native to Europe and temperate Asia, teasel may have been introduced to North America as early as the 1700s. It was likely cultivated for its role in producing wool or as an ornamental. Its frequent use in dried flower arrangements may aid its dispersal; for example, it is often found in and near cemeteries.

It occupies sunny and open sites, such as riparian areas, meadows, grasslands, roadways, forest openings, and disturbed sites. It may not seriously reduce biodiversity, but it has the potential to become more of a problem. Although few studies indicate the methods by which teasel impacts its nonnative habitats, several studies report that teasel may develop large monocultures, negatively impact riparian area integrity, and occupy habitats important to sensitive or threatened plant species.

Although several researchers and land managers consider teasel a potentially invasive nonnative species, common teasel was not a high-priority species in a list ranking those species thought to seriously reduce biodiversity. Common teasel was listed number 80 in a prioritized list of 81 nonnative invasive species in natural Canadian habitats. However, several morphological and reproductive characteristics suggest teasel has the potential to be a problematic invasive species. A review reports that teasel's thick, well-developed taproot allows for substantial nutrient and water storage, which increases the potential for regrowth after damage and/or survival of inclement conditions. Barbs and spines defend teasel against herbivory and may focus grazing or browsing on unprotected associated vegetation. High levels of seed production, high seed germinability, and little dormancy in fresh seed allows for rapid establishment in open areas, and death of the parent provides habitat for future seedling recruitment.

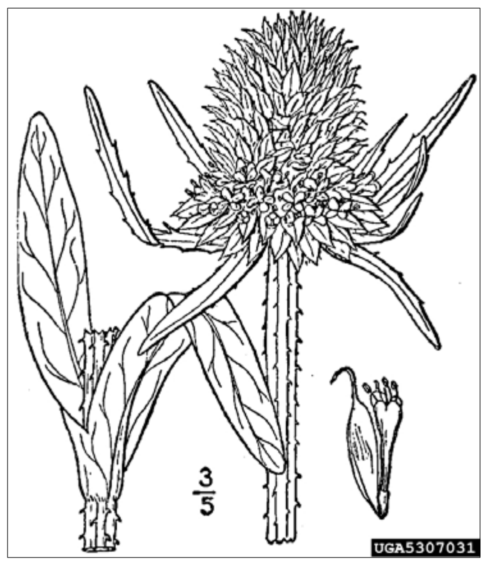

Image courtesy of USDA PLANTS Database, USDA NRCS PLANTS Database, Bugwood.org

While some teasel plants may be killed by cutting or mowing, many sprout and some may still produce seed. Typically, researchers and land managers suggest that belowground cutting is most effective, but plants may still regenerate. Reduced seed production and plant death are most likely if plants are cut just before or as they flower. However, viable seeds may be produced on cut stems, making disposal of flowering stems in cut areas important to successful teasel control.

Tree of Heaven (*Ailanthus altissima*) (AIAL)

This information comes from the National Park Service's Integrated Pest Management Manual.

Tree of Heaven is in the family Simaroubaceae. It was introduced into the United States from China as a host tree for the Cynthia moth, *Samia cynthia* (Drury), which was introduced for silk production. It was brought to the eastern United States as nursery stock because of its ability to grow quickly under adverse conditions. Chinese miners also brought the seeds with them to California because of their medicinal and cultural importance. Distribution in the United States is from Massachusetts to Iowa and Kansas and south to southern Texas and Florida. Tree of heaven has established to a lesser extent in the western United States from southern Rockies to the Pacific Coast states.

It is a tall (to 60 feet), deciduous, polygamous tree and often colonizes by root sprouts. Stump sprouts can grow 6-12 feet in length in a single summer. Flowers are present in late May through early June in 12-inch-long terminal panicles. A large cluster of pink fruits develops from July to October. The flowers and vegetative parts, if bruised, are ill scented, almost nauseating, on hot days.

Tree of Heaven is intolerant of deep shade and occurs most commonly along fence rows, roadsides, and waste areas. It is tolerant of urban conditions, including compacted, poor soils, and polluted air, and is common in dusty, smoggy areas such as inner cities where most other trees fail. It is often used as an ornamental in urban areas. It spreads rapidly in disturbed areas and can quickly take over forest openings created by gypsy moth damage or fire. It can pose a serious threat to natural areas. It has been found growing up to two air miles from the nearest seed source.

Photo courtesy of USDA PLANTS Database, USDA NRCS PLANTS Database, Bugwood.org

Cutting the tree by removing all above-ground growth does not prevent regeneration of sprouts from the stump. Current treatment consists of felling the tree and treating the stump with herbicide. Chemical treatment kills remaining tissue and prevents regrowth of stump sprouts. Trees may be frilled and treated with felling, treated by injection, or treated by hack and squirt. The latter technique involves cutting into the cambium and applying a herbicide into the wound.

Appendix 3. Herbicides: Characteristics, Effects, and Risk Assessments

[Replaces introductory paragraphs and table S-67 replaces table 57]

This appendix provides a summary of the available scientific information about the characteristics and effects of herbicides proposed for use in this project. Detailed information can be found in literature cited in the EIS as well as on national and regional Web sites managed by other agencies and organizations including the Environmental Protection Agency (EPA), USDA Forest Service, The Nature Conservancy, and the Colorado Department of Agriculture.

A key component of this analysis is the individual risk assessments developed by the Forest Service for each herbicide. Each risk assessment discusses the formulations analyzed for use in this project. These risk assessments were developed to determine the risk of using each herbicide, with worksheets provided to evaluate the risk at project level circumstances (such as application rate and application method). The risk assessments provide Forest Service officials with a summary of the most relevant information available. They are not comprehensive summaries of all the available information. After comments on the 2004 DEIS raised concerns about whether the evaluation of effects was adequate, the risk assessments were reexamined. As a result, this appendix incorporates by reference the 13 risk assessments available to date:

Table S-67. Risk Assessments

	Herbicide Name	Date Prepared	Reference
1	Aminopyralid	June 28, 2007	SERA 2007
2	2,4-D	September 30, 2006	SERA 2006
3	Clopyralid	December 5, 2004	SERA 2004c
4	Chlorsulfuron	November 21, 2004	SERA 2004a
5	Dicamba	November 24, 2004	SERA 2004b
6	Glyphosate	March 1, 2003	SERA 2003a
7	Hexazinone	October 25, 2005	SERA 2005
8	Imazapic	December 23, 2004	SERA 2004f
9	Imazapyr	December 18, 2004	SERA 2004e
10	Metsulfuron	December 9, 2004	SERA 2004d
11	Sulfometuron	December 14, 2004	SERA 2004b
12	Picloram	June 30, 2003	SERA 2003c
13	Triclopyr	March 15, 2003	SERA 2003b

Any cited references to the risk assessments in the FEIS, the draft SEIS, or the remainder of these appendices are hereby updated with the ones listed above.

Program Description

[Add aminopyralid (see table S-68) to table 58]

Table S-68. Herbicide use program description

	Herbicide Name	Other Information
1	Aminopyralid	A *reduced risk* herbicide used post-emergence to control annual, biennial and perennial broadleaf weed species inlcuding thistles and knapweeds. Also has excellent pre-emergence soil residual activity.

Application Methods

[No change from FEIS, except add aminopyralid (see table S-69) to table 59 and correct table 60 with information in table S-70]

Table S-69. Herbicides formulations, application rates, target plants

	Herbicide Name	Trade Name(s)	Application Rate (pounds per acre)	Target Invasive Plants
1	Aminopyralid	Milestone, Milestone VM	0.03 to 0.11	Thistles, knapweeds, yellow starthistle

Table S-70. Herbicide risk assessment standard terminology

Term	Abbrev	Explanation (see risk assessments for specific definitions)
Lowest Observed Effect Concentration	LOEC	Used for plants to determine the lowest concentration at which a concentration of herbicide had no effect.

Overall Conclusions

[No change from FEIS]

Human Health Risk Assessment

[No change from FEIS]

Factors Affecting Hazard of Herbicides

[No change from FEIS except as noted]

[Add aminopyralid to table 61 as shown in table S-71]

Table S-71. Herbicide characteristics

Herbicide	Carcinogenic[1]	Mutagenic and Reproductive[2]	Acute oral LD50 for rats (mg/kg/day)
Aminopyralid	E	No	>2000

1. EPA carcinogenicity classification based on daily consumption for a 70-year life span. D = Not Classifiable as to Human Carcinogenicity; E = Evidence of Non-Carcinogenicity

2. Unlikely that compound is mutagenic or would pose a mutagenic risk to humans at expected exposure levels.

Source: SERA 2007.

[This section updated]

Potential for Exposure

While the toxicity of a substance is the first part of the risk assessment, the second equally important consideration is the potential for exposure. The dose level that causes an effect in many toxicological studies is exponentially greater than what an applicator would be exposed to while applying herbicides. The method of exposure to herbicides in animal studies is also different than that of a worker or the general public, which also magnifies the chemical effect. In animal studies, herbicides are commonly pumped into stomachs, put directly into food, or placed directly on shaved skin. Potential exposure levels to workers and the general public associated with use of herbicides on forest lands have been estimated to be at or below EPA reference doses. Therefore, dosages would not exceed acute toxicity dose levels when applying herbicides on forest lands.

Herbicide applicators and the general public are clothed and do not purposely ingest herbicides under the same conditions as animal studies of toxicological significance. Estimates of exposure to workers and the general public to herbicides applied to forest lands have been reported under various conservative exposure scenarios. The most reasonable interpretation of the risks associated with application of most herbicides on national forest lands is that, except for accidental exposures or extremely atypical and perhaps implausible exposures scenarios (i.e., acute direct spray entirely covering a naked child), the use of herbicides on national forest lands would not pose an identifiable risk to workers or the general public.

Exposures under typical exposure scenarios (those following guidelines on the label) would be below the reference dose, a dose level determined to be safe by EPA over a lifetime of daily exposure.

There are exceptions worth noting that may help identify protective measures that could be instituted when applying herbicides.

- USDA Forest Service (SERA 2005) reports that over a range of plausible application rates, workers may be exposed to hexazinone at levels that exceed the reference dose.
- Likewise, there is reasonable concern that workers applying triclopyr over a prolonged period of time in the course of a single season and/or several seasons may be at risk of impaired kidney function (SERA 2003).
- SERA (2006) reports that if 2,4-D were applied directly to fruits and vegetables at anticipated application rates, the consumption of vegetables would be undesirable and could lead to health effects. These reports also point out that the likelihood of such an exposure seems remote when applying on forest lands. Given the concern with the consumption of forest vegetation by the local population, this route of exposure is more likely than elsewhere in the United States and should be considered in the implementation process to avoid these exposures.
- SERA (2006) reports that exposure levels for workers involved in ground or aerial application of 2,4-D may exceed the reference dose slightly, based on central estimates of exposure, or substantially, based on upper limits of exposure. They go on to indicate that 2,4-D can be applied safely (exposure doses below the reference dose) if effective methods are used to protect workers and minimize exposure (personal protective equipment).

- SERA (2003) reported that there is no evidence that typical exposures to picloram would lead to a dose level that exceeds the reference dose or level of concern with the exception of wearing contaminated gloves for 1 hour, which results in estimates of absorbed doses that exceed the reference dose.
- SERA (2003) notes that exposure of workers to formulations of triclopyr over a long duration could exceed the level of concern, and so these levels should be avoided.
- SERA (2007) explains the EPA has judged that aminopyralid appears to be a *reduced risk* herbicide. This judgment by the EPA is supported by the current risk assessment. Aminopyralid is an effective herbicide. As with any effective herbicide applied to terrestrial weeds, adverse effects in nontarget terrestrial plants are plausible. There is no indication, however, that adverse effects on workers, members of the general public or other nontarget animal species are likely. This assessment of aminopyralid is tempered by the lack of information on aminopyralid in the open literature. All of the information on the toxicity of aminopyralid comes from studies that have been submitted to the EPA in support of aminopyralid registration. While these studies have been reviewed and the bulk of these studies appear to have been appropriately designed, conducted and reported, the available information on aminopyralid is much less diverse than the information that is available on herbicides that have been used for many years and for which the open literature is rich and varied.

How herbicides are applied can have a direct impact on the potential for human exposure and subsequent adverse health effects. According to risk assessments completed on herbicide usage on national forest lands, herbicide applicators are at a higher risk than the general public from herbicide use. The risk assessments compared risks to workers for all types of application, including aerial, backpack, ground-mechanical, and hand applications. Lower risks were estimated for aerial and ground-mechanical application as compared to other methods, even though the total amount of herbicide applied in a given day was higher (SERA 1995-2007).

Risks associated with backpack and hand application of herbicides were estimated to be the highest, due to workers being closer to the nozzle and to the containers from which the herbicides were sprayed. Backpack and hand application was also reported to increase the likelihood of a worker receiving repeated exposures that may remain on the worker’s skin for an extended time period. The EPA, in its reregistration of picloram (EPA 1995), also noted that the highest risk for herbicide applicators was for those using the backpack application method, the lowest for aerial and ground-boom applicators. Although this is true in general, risk assessments worksheets run on the likely application rates and methods for the two national forests, found this exposure reversed for 2,4-D applicators.

Route of Exposure

[Add aminopyralid to table 62 as shown in table S-72]

Table S-72. Exposure risk of herbicides

Herbicide	RfD[1] (mg/kg/day)	Estimated Exposure to Public[2]	Estimated Exposure to Worker[2]
Aminopyralid	0.5	Less than RfD[3]	Less than RfD (0.001 – 0.002)

1. RfD = reference dose. A daily dose expressed as milligrams of herbicide per kilogram of body weight = mg/kg
2. Exposures under typical exposure scenarios. Accidental and extreme exposure scenarios may exceed the RfD.

3. Based on modeling of the Most Exposed Individual, SERA found “based on a generally conservative and protective set of assumptions regarding both the toxicity of aminopyralid and potential exposures to aminopyralid, there is no basis for suggesting that adverse effects are likely in either workers or members of the general public even at the maximum application rate that might be used in Forest Service [or NPS] programs.”

Source: SERA 2007

Wildlife Risk Assessment

[No change from FEIS, except that 13 herbicides (not 12) are proposed for use]

[Add aminopyralid to table 63 as shown in table S- 73]

Table S- 73. Relative risk of each herbicide

Herbicide	Worker Risk	Public Risk	Risk of Carcinogenicity	Risk to Plants, Direct	Rick to Plants, Drift/runoff	Aquatic Plants Risk	Animals Direct Risk	Aquatic Animal Risk	Notes
Aminopyralid	○ ○ ○ ○ ●	○ ○ ○ ○ ●	NA	○ ○ ○ ● ●	○ ○ ● ● ●	○ ○ ● ● ●	○ ○ ○ ○ ●	○ ○ ○ ○ ●	

Key:	○ ○ ○ ○ ○	The greater the number of dark dots, the higher the relative risk for that area of concern.

[Add aminopyralid to table 64 as shown in table S-74]

Table S-74. Effects of Each Herbicide

Herbicide	Carcinogen (Cancer)	Teratogen (Birth Defects)	Mutagen (Genetic Damage)	Reproductive Inhibitor	Skin Irritant	Eye Irritant	Bio-Accumulate	Toxicity to Birds	Toxicity to Bees	Toxicity to Mammals	Target Plants
Aminopyralid	No	No	No	No	Slight	None	Minimal	Practically nontoxic	Practically nontoxic	Low	Broadleaf plants

Aquatic Risk Assessments

[No change from FEIS except to add aminopyralid to table 65 as shown in table S-75]

Table S-75. Level of Concern for Chemical Use Using the Risk Quotient Method

Chemical	1/20 Of LC_{50} (ppm)[1]	EEC[2] (ppm)	Risk Quotient[3]	Level of Concern
Aminopylarid (Milestone)	6.0	0.1	0.1	Low

1. LC_{50} = Lethal Concentration where 50% mortality occurs. The current risk assessment will use NOEC values rather than LC_{50} values for risk characterization. For aminopyralid, however, the resulting numbers are essentially identical to those of the U.S. EPA because most of the >LC_{50} values used by U.S. EPA/OPP-EFED (2004) are actually NOEC values – i.e., no mortality or sublethal effects were observed.
2. EEC = expected environmental concentration; ppm = parts per million.
3. This is below the level of concern by a factor of 10 (SERA 2007).

Specific Herbicide Characteristics and Environmental Effects

[Add aminopyralid, otherwise no change from FEIS]

Aminopyralid

Aminopyralid is a relatively new pyridine carboxylic acid herbicide for controlling weeds and invasive plants on rangeland and pastures, rights-of-way, and wildlife habitat areas. It is particularly effective on musk and Canada thistles; spotted, diffuse, and Russian knapweeds, yellow starthistle, and other difficult-to-control broadleaf weeds (SERA 2007). It is primarily a post-emergence herbicide, but has excellent pre-emergence soil residual activity. Aminopyralid can be applied to weeds at any stage of growth, but it works best when used during the specific weed(s) optimal growth stages for control. Residual activity control can last into the season after treatment on certain weed species.

Aminopyralid translocates throughout the entire plant, accumulating in meristematic tissues including the roots, effectively disrupting the plants' growth metabolic pathways and eradicating susceptible broadleaf plant species. Aminopyralid has been shown to cause little or no injury to desirable cool- and warm-season grasses. Aminopyralid will not cause injury to mature tree species, such as pine, maple and ash but can cause some leaf discoloration, curling or other foliage symptoms from over-application; however, leguminous trees, such as black locust and honey locust can be seriously injured by under-tree application.

The EPA considers aminopyralid a *reduced risk* herbicide because there is no evidence of adverse effects on workers, members of the general public, or wildlife and domestic animals. However, as with all relatively new herbicides, there is little information available in the published literature on the toxicity of aminopyralid to humans or other mammalian species, and the few currently available for assessing potential hazards in humans are those supporting its registration.

Acute toxicity data indicate that aminopyralid has low mammalian toxicity via oral, dermal and inhalation routes of exposure (U.S. EPA 2005) for both technical and end-use formulations. The acute oral LD_{50} and dermal LD_{50} in rats were greater than 5,000 mg/kg, respectively, while the acute inhalation LC_{50} was greater than 5.5 mg/L. In a metabolism study in rats, it was rapidly absorbed, distributed, and excreted following oral administration. Dermal irritation was negative for the aminopyralid technical. Eye irritation ranged from a slight, transient irritation to irritating for aminopyralid formulations.

Aminopyralid has been classified as "not likely" to be carcinogenic to humans; nor has it been found to be teratogenic, mutagenic, neurotoxic, or a reproductive hazard. It has tested negative for genotoxicity in both in *vitro* and in *vivo* systems with no long-term (chronic) toxicity evident. The aminopyralid human health and risk assessment (SERA 2007) and the EPA determined that no risks to workers or members of the general public are anticipated.

Toxicity studies on terrestrial plants reveal that broadleaf plants are substantially more sensitive to aminopyralid than monocots (e.g., grasses), which is consistent with the recommended uses of aminopyralid. As would be expected from a herbicide, some aquatic plants are more sensitive than aquatic animals to the effects of aminopyralid.

Relatively little information is available on the standard acute and chronic toxicity of aminopyralid to terrestrial invertebrates or terrestrial microorganisms; however, based on bioassays in honeybees, earthworms, and soil microorganisms, aminopyralid does not appear to be very toxic to terrestrial invertebrates or soil microorganisms; nor is there any indication that it is likely to be toxic to aquatic animals, also based on bioassays in fish and invertebrates.

Inert/Other Ingredients

[Add aminopyralid to table 66 as shown in table S-76]

Table S-76. Herbicide formulations, impurities, other ingredients

	Herbicide Name	Hazard Identification
1	Aminopyralid	Impurities, adjuvants and metaobolites are considered together in the risk assessment. Formulations covered in this risk assessment contain only the triisopropanolamine (TIPA) salt of aminopyralid and water. TIPA would be classified marginally as Category III (*Caution*), which applies to compounds with oral LD50 values in the range of >500 to 5,000 mg/kg. Similar to picloram and clopyralid, aminopyralid was developed to exclude hexachlorobenzene, a persistent carcinogen found in picloram and clopyralid, and other chlorinated.

Appendix 4. Effects of Nonherbicide Weed Control Methods

[No change from FEIS]

Appendix 5. Herbicide Model for Watershed Analysis

[No change from FEIS]

Appendix 6. Chemical Spill Prevention and Cleanup Plan

[No change from FEIS]

Appendix 7. Weed Populations and Treatments

[Replaces entire section]

This appendix lists the weed species known in the project area as of August 1, 2013 and the proposed method(s) by which they would be treated. Where several species grow in the same vicinity, they are grouped together. More than one treatment is listed in alternatives B and C because different species respond to different treatments depending on their ecology and location. Thus, the tables show the *maximum* number of acres that would be treated by the method shown.

Note that treatments are not limited to only the known weed populations. The adaptive nature of this project, described in chapter 2, will allow the Forest Service to treat new populations of weeds as they are discovered. In fact, recent studies show that treating new populations before the seedbed is established is the most effective and least costly strategy for reducing and eliminating weeds (Frid et al. 2013).

The acreages and treatment methods provided here are a snapshot in time, helpful as a basis for evaluating the effects of weeds and the treatments.

Keys to abbreviations:

Weed Species

Code	Scientific Name	Common Name
ACRE3	*Acroptilon repens*	hardheads; Russian knapweed
AIAL	*Ailanthus altissima*	tree of heaven
BRTE	*Bromus tectorum*	cheatgrass
CADR	*Cardaria draba*	whitetop; hoary cress
CANU4	*Carduus nutans*	nodding plumeless thistle; musk thistle
CEDI3	*Centaurea diffusa*	diffuse knapweed
CESO3	*Centaurea solstitialis*	yellow star-thistle
CESTM	*Centaurea stoebe ssp. micranthos*	spotted knapweed
CIAR4	*Cirsium arvense*	Canada thistle
CIVU	*Cirsium vulgare*	bull thistle
COMA2	*Conium maculatum*	poison hemlock
DIFU2	*Dipsacus fullonum*	Fuller's teasel
ELAN	*Elaeagnus angustifolia*	Russian olive
EUES	*Euphorbia esula*	leafy spurge
HYNI	*Hyoscyamus niger*	black henbane
LELA2	*Lepidium latifolium*	broadleaved pepperweed
LIDA	*Linaria dalmatica*	Dalmatian toadflax
LIVU2	*Linaria vulgaris*	butter and eggs; yellow toadflax
ONAC	*Onopordum acanthium*	Scotch cottonthistle
TARA	*Tamarix ramosissima*	saltcedar
ULPU	*Ulmus pumila*	Siberian elm

Treatment Method	Abbreviation
Biological	BIO
Grazing	GR
Herbicides	HE
Manual	MA
Mechanical	ME
Prescribed fire	FR

Table S-77. Summary of treatments for the action alternatives

Plant Species	Alternative B Treatments	Alternative C Treatments	Alternative D Treatments	Treatment Acres[1]
ACRE3	GR, HE, MA, ME	GR, MA, ME	HE	93.5
ACRE3 CADR	GR, HE, MA, ME	GR, MA, ME	HE	0.2
ACRE3 CANU4	GR, HE, MA, ME	GR, MA, ME	HE	0.2
ACRE3 CEDI3	GR, HE, MA, ME	GR, MA, ME	HE	0.0
ACRE3 CEDI3 ELAN TARA	BIO, GR, HE, MA, ME	BIO, GR, MA, ME	HE	0.1
ACRE3 CIVU	GR, HE, MA, ME	GR, MA, ME	HE	0.1
ACRE3 TARA	BIO, GR, HE, MA, ME	BIO, GR, MA, ME	HE	16.0
AIAL ULPU	HE, MA, ME	MA, ME	HE	0.1
BRTE	FR, GR, HE, MA, ME	FR, GR, MA, ME	HE	73.4
BRTE CANU4	HE, MA, ME	MA, ME	HE	0.5
CADR	BIO, HE, MA, ME	BIO, MA, ME	HE	34.7
CADR CIVU ELAN TARA ULPU	FR, HE, MA, ME	FR, MA, ME	HE	1.7
CADR CIVU TARA	FR, HE, MA, ME	FR, MA, ME	HE	1.0
CADR ELAN ULPU	FR, HE, MA, ME	FR, MA, ME	HE	0.7
CADR ONAC	BIO, HE, MA, ME	BIO, MA, ME	HE	18.7
CANU4	HE, MA, ME	MA, ME	HE	1,309.7
CANU4 CIAR4	GR, HE, MA, ME	GR, MA, ME	HE	2,265.7
CANU4 CIAR4 CIVU	GR, HE, MA, ME	GR, MA, ME	HE	2.8
CANU4 CIVU	HE, MA, ME	MA, ME	HE	137.5
CANU4 CIVU ELAN TARA ULPU	FR, HE, MA, ME	FR, MA, ME	HE	10.3
CANU4 CIVU ONAC	HE, MA, ME	MA, ME	HE	3.4
CANU4 CIVU TARA	HE, MA, ME	MA, ME	HE	1.8
CANU4 COMA2	HE, MA, ME	MA, ME	HE	0.1
CANU4 ELAN	HE, MA, ME	MA, ME	HE	0.0
CANU4 LIDA	BIO, HE, MA, ME	BIO, MA, ME	HE	8.3
CANU4 LIDA ONAC	HE, MA, ME	MA, ME	HE	0.8
CANU4 ONAC	HE, MA, ME	MA, ME	HE	1.4

Plant Species	Alternative B Treatments	Alternative C Treatments	Alternative D Treatments	Treatment Acres[1]
CANU4 TARA	HE, MA, ME	MA, ME	HE	0.3
CANU4 ULPU	HE, MA, ME	MA, ME	HE	0.6
CEDI3	HE, MA, ME	MA, ME	HE	173.1
CEDI3 ELAN TARA	BIO, HE, MA, ME	BIO, MA, ME	HE	328.4
CESO3	BIO, FR, GR, HE, MA, ME	BIO, FR, GR, MA, ME	HE	0.6
CESTM	HE, MA	MA	HE	25.9
CESTM CIAR4	GR, HE, MA, ME	GR, MA, ME	HE	313.3
CIAR4	GR, HE, ME	GR, ME	HE	2,999.4
CIAR4 CIVU	GR, HE, MA, ME	GR, MA, ME	HE	6.3
CIAR4 CIVU ELAN TARA ULPU	BIO, FR, GR, HE, MA, ME	BIO, FR, GR, MA, ME	HE	3.7
CIAR4 CIVU TARA	BIO, GR, HE, MA, ME	BIO, GR, MA, ME	HE	0.3
CIAR4 ELAN ULPU	FR, GR, HE, ME	FR, GR, ME	HE	0.0
CIAR4 LELA2 LIVU2 HYNI	BIO, GR, HE, ME	BIO, GR, ME	HE	43.0
CIAR4 ONAC	GR, HE, MA, ME	GR, MA, ME	HE	0.2
CIAR4 TARA	BIO, GR, HE, ME	BIO, GR, ME	HE	0.0
CIVU	BIO, HE, MA, ME	BIO, MA, ME	HE	2,877.6
CIVU COMA2	BIO, HE, MA, ME	BIO, MA, ME	HE	0.0
CIVU ELAN TARA ULPU	BIO, HE, MA, ME	BIO, MA, ME	HE	693.5
CIVU LIVU2	GR, HE, MA, ME	MA, ME	HE	0.1
CIVU ONAC	BIO, HE, MA, ME	BIO, MA, ME	HE	26.8
CIVU TARA	BIO, HE, MA, ME	BIO, MA, ME	HE	63.7
COMA2	BIO, HE, MA	BIO, MA	HE	22.2
DIFU2	HE, MA, ME	MA, ME	HE	0.1
ELAN	HE, ME	ME	HE	3.3
ELAN TARA	BIO, HE, ME	BIO, ME	HE	27.6
ELAN TARA ULPU	BIO, FR, HE, ME	BIO, FR, ME	HE	116.2
ELAN ULPU	BIO, FR, HE, ME	BIO, FR, ME	HE	64.4

Plant Species	Alternative B Treatments	Alternative C Treatments	Alternative D Treatments	Treatment Acres[1]
EUES	BIO, GR, HE	BIO, GR	HE	8.9
HYNI	HE, MA	MA	HE	0.6
LELA2	GR, HE, ME	GR, ME	HE	0.1
LIDA	BIO, GR, HE	BIO	HE	8.6
LIDA ONAC	BIO, GR, HE, MA	BIO, MA	HE	0.6
LIVU2	BIO, GR, HE	BIO	HE	3.6
ONAC	HE, MA	MA	HE	470.6
TARA	BIO, HE, ME	BIO, ME	HE	372.9
TARA ULPU	FR, HE, ME	FR, ME	HE	0.2
ULPU	FR, HE, ME	FR, ME	HE	617.1

1. A value of 0.0 means that less than one-tenth of an acre of a species exists.

Appendix 8. Implementation and Monitoring

[No change from FEIS]

Appendix 9. Response to Comments on the DEIS

[No change from FEIS]

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